



INSTITUTE FOR DEFENSE ANALYSES

Reduction of Total Ownership Costs (R-TOC) Best Practices Guide

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INSTITUTE FOR DEFENSE ANALYSES

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(R-TOC) Best Practices Guide**

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Preface

This document was prepared by the Institute for Defense Analyses for the Office of the Director of Defense Systems, under the task, Reduction of Total Ownership Costs. It addresses task objectives to provide continuing strategies, requirements, assessments, planning recommendations, and implementation guidance to specifically support these R-TOC initiatives.

This document was reviewed by IDA Research Staff Member, Dr. L. Roger Mason, Jr.

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Executive Summary

Background

The purpose of the Reduction of Total Ownership Costs (R-TOC) program is to achieve readiness improvements in weapon systems by improving the reliability of the systems or the efficiency of the processes used to support them. New technologies and management practices may provide significant opportunities to improve readiness and reduce ownership costs. In recent years, world-class suppliers have achieved cost reductions while making major improvements in customer support. Some Department of Defense (DoD) programs have achieved similar successes in adopting private sector improvements in logistics and supply chain management.

A May 1999 memorandum from the Under Secretary of Defense for Acquisition, Technology and Logistics (USD/AT&L) stressed that the purpose of R-TOC was to maintain or improve current readiness while reducing operations and support (O&S) costs. The memorandum instructed the Services to focus on three general R-TOC approaches.

- Reliability and maintainability (R&M) improvements
- Reduction of supply chain response time and reduction of logistics footprint
- Competitive product support

R-TOC Pilot Programs

Each of the Services designated 10 programs as R-TOC Pilot Programs to test R-TOC approaches and report on their experiences.

R-TOC Pilot Programs

Army Pilots	DoN Pilots	Air Force Pilots
Abrams Tank System	Advanced Amphibious	Airborne Warning and Control System (AWACS)
Apache	Assault Vehicle (AAAV)	B-1
CH-47	CG-47 AEGIS Class Cruisers	C-17
Comanche	Aviation Support Equipment	C-5
Fire Support C2	Common Ship	Combatant Commanders' Integrated Command and Control System (CCIC2S)
Guardrail/Common Sensor	CVN-68 Class Carriers	C/KC-135
Heavy Expanded Mobility Tactical Truck (HEMTT)	EA-6B	F-117
Improved Target Acquisition System (ITAS)	H-60	F-16
Precision Fires	LPD-17	Joint Surveillance Target Attack Radar System (JSTARS)
Unmanned Aerial Vehicle (UAV) Systems	Medium Tactical Vehicle Replacement (MTVR)	Space Based Infrared Systems (SBIRS)
	Standard of Land Attack Missile - Expanded Response (SLAM-ER)	

The Pilots included systems representing the full acquisition life cycle, from systems in development through fielded systems. OSD established a goal of reducing fiscal year (FY) 05 O&S costs by at least 20 percent compared to a baseline established in FY99.

Each Pilot Program prepared an R-TOC baseline, an implementation plan, and an estimate of R-TOC cost savings resulting from implementation of the plan. The R-TOC Working Group held the first R-TOC Forum in August 1999. At this Forum, about one-third of the Pilot programs presented their R-TOC baselines and implementation plans while the others presented a general overview of the program and the program's approach to R-TOC. Since August 1999, the Working Group has held forums each quarter to exchange information among the Pilot Programs and explore specific issues.

At each Forum, approximately a quarter of the Pilot Programs present update briefings on their progress implementing R-TOC. This allows OSD and Service staffs to stay abreast of the Pilot Programs' progress while minimizing briefing demands on the Pilot Programs. It also allows the Pilots to share their experiences with other programs implementing R-TOC and to gain the benefits of what has worked (or not worked) for other programs.

R-TOC Implementation

R-TOC can be implemented by programs at all stages in the acquisition process, but the approach may be quite different, depending on where the program is in the life cycle. Solutions that may be relatively easy to design into a new system may be impossible to implement in a fielded system, which already has a finished design and an established logistics support system. On the other hand, fielded systems provide a real experience baseline so that it is possible to identify actual subsystems or processes that reduce reliability, increase O&S costs, or increase maintenance cycle time.

Reducing TOC is a continuous process, not a one-shot reporting requirement. Some Pilot Programs basically are just continuing to monitor the same set of TOC reduction initiatives that they originally developed in 1999. But the programs that are most successful in reducing TOC continue to pursue funding for initiatives that have initially been rejected and continue to refine ongoing initiatives and develop new ones.

R-TOC and Other DoD Initiatives

R-TOC is closely related to a number of other DoD initiatives. Cost as an Independent Variable (CAIV) is a methodology for reducing TOC and improving performance. It involves developing, setting, and refining aggressive unit production cost objectives and O&S objectives while meeting warfighter requirements. Like R-TOC, it is essential to involve the user community in the tradeoff process from the beginning to achieve the best outcome for all parties involved.

Total Life Cycle Systems Management (TLCSM) establishes the program manager (PM) shall be the single point of accountability for accomplishment of program objectives for life cycle systems management, including sustainment (DoDD 5000.1, E1.29). Many of the R-TOC Pilot Programs have played important roles in developing and refining the TLCSM concept.

Performance Based Logistics (PBL) is a new initiative, sponsored by the Deputy Under Secretary for Logistics and Materiel Readiness, which address a key R-TOC objective.

According to DoD's guidance for PBL, "PMs shall develop and implement performance based logistics strategies that optimize total system availability while minimizing cost and logistics footprint. Sustainment strategies shall include the best use of public and private sector capabilities through government industry partnering initiatives, in accordance with statutory requirements." Most R-TOC Pilots are developing PBL approaches.

Value Engineering (VE) is the systematic effort directed at analyzing the functional requirements of systems, equipment, facilities, processes, and supplies for the purpose of achieving essential functions at the lowest total cost, consistent with needed performance, safety, reliability, maintainability, and quality. VE methods can be used throughout a system's life to simultaneously optimize system functionality and reduce cost. Contractor ideas are submitted using the Value Engineering Change Proposal (VECP) and are rewarded through the sharing of savings from the instant contract, related contracts, and future contracts. On legacy systems, the VECP remains one of the principal, established and proven tools for reducing cost and enhancing system performance, and can be an important complement to R-TOC.

R-TOC Best Practices

The documentation and dissemination of Best Practices is one of the central purposes of the R-TOC program. The experience of the Pilot Programs has shown that R-TOC works. Pilot Programs have undertaken a wide variety of initiatives that have improved system reliability, improved supply chain responsiveness, and promoted improved logistics support. Because they represent a wide range of acquisition phases and systems/subsystem types, the R-TOC Pilot Programs provide an opportunity to test almost every conceivable TOC reduction initiative. These examples provide a fertile storehouse of Best Practices that can be adapted or applied by other programs.

But, despite the documented successes of the Pilot Programs in using R-TOC initiatives to improve system performance and reduce O&S costs, implementation of R-TOC across DoD systems remains more the exception than the rule. Sharing these experiences with other programs can help with the more widespread implementation of R-TOC.

R-TOC Best Practices are documented in the areas of:

- R-TOC Management
- R-TOC Tools
- Acquisition Practices
- R&M Improvements
- Supply Chain Response Times and Footprint Reduction
- Competitive Product Support

More information about R-TOC can be found at: <http://rtoc.ida.org>.

1. INTRODUCTION

1.1 Background

The Department of Defense (DoD) wide effort to reduce total ownership costs (R-TOC) grew out of numerous reviews and discussions at Program Executive Officers'/Systems Command (PEO/SYSCOM) Commanders' conferences, the Defense Science Board, and others. The R-TOC program was established in response to longstanding concerns about the adverse impact of defense budgetary and operational trends on force structure and readiness. Declining procurement funds are resulting in a rapidly aging (and potentially inefficient and unsupportable) inventory. Rising operations and support (O&S) costs can consume higher portions of defense budget resulting in less funding available for system upgrades on new systems.

The purpose of the R-TOC program is to achieve readiness improvements in weapon systems by improving the reliability of the systems or the efficiency of the processes used to support them. New Technologies and management practices may provide significant opportunities to improve readiness and reduce ownership costs. In recent years, world-class suppliers have achieved cost reductions while making major improvements in customer support. Some DoD programs have achieved similar successes in adopting private sector improvements in logistics and supply chain management.

DoD's leadership has endorsed the continuation and expansion of R-TOC. Under Secretary (AT&L) Edward C. Aldridge has made R-TOC savings one of his principal areas of concern.

1.1.1 R-TOC Pilot Programs

Section 816 of FY99 Defense Authorization Act instructed DoD to select 10 programs to test program manager oversight of life cycle costs (PMOLCS). Although DoD submitted 10 "Section 816 pilots" to Congress for their continuing review, DoD ultimately decided to use 30 programs as pilots to test the R-TOC concept. The 30 Pilot Programs are shown in Table 1-1.

The Pilots included platforms, munitions, and equipment at all stages of the acquisition process from development through fielded systems (see Table 1-2). This allowed the Pilots to explore the maximum range of potential TOC reduction measures and to identify the major opportunities and stumbling blocks at each phase of the acquisition process.

1.1.2 Pilot Program Objectives

A May 1999 memo from the Under Secretary of Defense for Acquisition, Technology and Logistics (USD/AT&L) stressed that the purpose of R-TOC was to maintain or improve current readiness while reducing O&S costs. The memo instructed the Services to focus on three general R-TOC approaches.

- Reliability and maintainability (R&M) improvements
- Reduction of supply chain response time and reduction of logistics footprint
- Competitive product support

Table 1-1. R-TOC Pilot Programs

Army Pilots	DoN Pilots	Air Force Pilots
Abrams Tank System Apache CH-47 Comanche Fire Support C2 Guardrail/Common Sensor Heavy Expanded Mobility Tactical Truck (HEMTT) Improved Target Acquisition System (ITAS) Precision Fires Unmanned Aerial Vehicle (UAV) Systems	Advanced Amphibious Assault Vehicle (AAAV) CG-47 AEGIS Class Cruisers Aviation Support Equipment Common Ship CVN-68 Class Carriers EA-6B H-60 LPD-17 Medium Tactical Vehicle Replacement (MTVR) Standard of Land Attack Missile - Expanded Response (SLAM-ER)	Airborne Warning and Control System (AWACS) B-1 C-17 C-5 Combatant Commanders' Integrated Command and Control System (CCIC2S) C/KC-135 F-117 F-16 Joint Surveillance Target Attack Radar System (JSTARS) Space Based Infrared Systems (SBIRS)

Table 1-2. Pilot Programs by Service and Acquisition Phase

	Army	DoN	Air Force
Development Systems	Comanche	AAAV	
Production Systems	ITAS UAV Systems	LPD-17 MTVR SLAM-ER	C-17 JSTARS
Mixture of Developmental and Fielded Systems	Fire Support C2 Precision Fires	Aviation Support Equipment H-60	CCIC2S SBIRS
Fielded Systems ¹	Apache Abrams CH-47 Guardrail HEMTT	CG-47 AEGIS Class Cruisers Common Ship CVN-68 Class Carriers EA-6B	AWACS B-1 C-5 C/KC-135 F-16 F-117

At the same time, the DoD “Strategy for Affordability”² established a 20 percent O&S cost reduction goal for FY05. The 30 Pilot Programs were instructed to develop an

¹ Some “fielded” systems have continuing production and others have ongoing major modifications or upgrade programs.

² “Into the 21st Century – A Strategy for Affordability,” IDA, January 20, 1999.

R-TOC baseline and implementation plan. These plans were submitted in October 1999. Other activities by the Pilot Programs included:

- Identifying proposed R-TOC initiatives (funded and unfunded)
- Submitting quarterly reports and lessons learned
- Documenting obstacles to accomplishment of R-TOC goals and proposed methods to surmount these obstacles

1.1.3 R-TOC Forums

The R-TOC Working Group consists of representatives of key Office of the Secretary of Defense (OSD) functional organizations, the Defense Logistics Agency (DLA), and Service staff R-TOC organizations. The Working Group meets regularly to review progress, identify and resolve problems, and coordinate activities.

The Working Group held the first R-TOC Forum in August 1999. At this Forum, about 1/3 of the Pilot programs presented their R-TOC baselines and implementation plans while the others presented a general overview of their program and their program's approach to R-TOC. Since August 1999, the Working Group has held forums each quarter to exchange information among the Pilot Programs and to explore specific issues.

At each Forum approximately a quarter of the Pilot Programs present update briefings on their progress implementing R-TOC. This allows OSD and Service staffs to stay abreast of the Pilot Programs' progress while minimizing briefing demands on the Pilot Programs. It also allows the Pilots to share their experiences with other programs implementing R-TOC and to gain the benefits of what has worked (or not worked) for other programs. Many Pilot Programs have commented about the benefits to their program from the information exchanges at these Pilot Forums. For example, EA-6B observed that: "The quarterly forum provides an opportunity to exchange ideas across services and programs." The Heavy Expanded Mobility Tactical Truck (HEMTT) cited benefits it gained from the experience of another Pilot Program, the Medium Tactical Vehicle Replacement (MTVR):

*"We also are looking at the impact on fleet O&S costs of introducing improved driver trainer simulators into the training base, which is being funded through FY05 on various tactical vehicles, including HEMTT. We are looking closely at the DoN pilot Medium Tactical Vehicle Replacement program which has already identified a similar effort as one of their pilot initiatives."*³

The Working Group has explored specific R-TOC issues in-depth at some of the Forums. Specific topics have included:

- Long term partnering support (3rd Forum)
- Incentives (and the DoD Incentives Guide) (4th Forum)

³ Heavy Expanded Mobility Tactical Truck (HEMTT) R-TOC Pilot Program Quarterly Progress Report, May 2002.

- Legislative and regulatory barriers (5th Forum)
- Performance-based Pilots (6th, 8th, and 12th Forums)
- Development and improvement of O&S and other R-TOC tools by the Services and by Pilot Programs (7th and 10th Forums)
- Incentives under sole source arrangements (8th Forum)

These topics have been addressed both by the Pilot Programs (who are provided with a standard set of questions to address) and by special presentations from government functional organizations, contractors, or others at the Forums.

Forums have also provided an opportunity for Pilot Programs to gain firsthand knowledge about new OSD, Service, and defense agency initiatives and resources, such as:

- DLA activities in support of weapons systems (5th and 11th Forums)
- OSD and Service plans to implement Performance based logistics (8th, 9th, and 12th Forums)
- Naval Air Systems Command (NAVAIR), Air Force, and Army depot activities (10th, 11th, and 14th Forums)
- Commercial Operations and Support Savings Initiative (COSSI) (10th Forum)
- Condition Based Maintenance (11th Forum)

1.2 R-TOC Benefits

The experience of the Pilot Programs has demonstrated R-TOC's success. Pilot Programs have undertaken a wide variety of initiatives that have improved system reliability, improved supply chain responsiveness, and promoted improved logistics support. Since they represent a wide range of acquisition phases and systems/subsystem types, the R-TOC Pilot Programs provide an opportunity to test almost every conceivable TOC reduction initiative. These examples provide a fertile storehouse of Best Practices that can be adapted or applied by other programs.

The CVN-68 Carriers Pilot Program cited the benefits that are being achieved throughout the Carriers PEO:

“PEO Carriers has applied the R-TOC approach across the entire Aircraft Carrier fleet, including the conventionally powered carriers and the new development carriers. This will allow benefits from new development efforts (CVN-77, CVNX 1 and 2) to be applied to the existing fleet of Aircraft Carriers. Additionally, it allows R-TOC initiatives to be applied to the new construction efforts, as they are being designed and built.”⁴

Even if there were no leverage to other programs, just the savings and other achievements of the Pilot Programs themselves are significant. Because the Pilot Programs include some of the principal O&S cost drivers for each Service (e.g., Abrams tank, Apache

⁴ CVN-68 R-TOC Pilot Program Quarterly Progress Report, February 2003.

helicopter, CVN-68 carriers, AEGIS cruisers, C-5, F-16, B-1, and C/KC-135 tankers), the savings achieved within these programs have a significant impact on overall O&S spending. The estimated O&S savings achieved by the Pilot Programs for FY05 will exceed \$1.3B, with savings generally increasing in subsequent years.

Sometimes, the survival of the program can depend on the program's success in reducing TOC. General Joseph W. Ralston, former commander of Air Combat Command and current Commander, U.S. European Command and Supreme Allied Commander Europe, has observed that "B-1 cost of ownership is more threatening to the aircraft than the enemy."

Since so many of the R-TOC Pilots are themselves high-demand weapon systems, small O&S cost reductions or readiness or supply chain improvements can make drastic improvements in our force readiness. Many of the R-TOC Pilots (e.g., CH-47, Guardrail, ITAS, SLAM-ER, EA-6B, AWACS, JSTARS, B-1, C/KC-135, C-5, C-17) have played key roles in support of Operation Enduring Freedom or other frontline operations in the war on terrorism, so reductions in maintenance costs, improvements in operational readiness (OR) rates, or improvements in the parts supply pipeline can have a major impact on our force potential.

1.3 Purpose of this Guide

The purpose of this Guide is to help DoD programs implement R-TOC. Despite the documented successes of the Pilot Programs in using R-TOC initiatives to improve system performance and reduce O&S costs, implementation of R-TOC across DoD systems remains more the exception than the rule. This Guide will:

- Describe a process for implementing R-TOC at various acquisition phases and discusses the wide range of R-TOC activities that the Pilot Programs have pursued (Chapter 2)
- Discuss some key issues and barriers to R-TOC (Chapter 3)
- Describe some Pilot Program best practices that may be applicable to other programs (Chapter 4)
- Discuss lessons learned and other observations from Pilot Programs about the effectiveness of the R-TOC program itself (Chapter 5)

More information about R-TOC can be found at: <http://rtoc.ida.org>.

2. IMPLEMENTING R-TOC

2.1 R-TOC Implementation Steps

While every program is different, there is a general sequence of steps a program should follow to implement R-TOC. This chapter discusses these actions and describes how a program's approach to R-TOC might differ depending on the program's acquisition phase.

A Defense Acquisition University course on R-TOC identifies the following key implementation steps that most programs should follow to implement R-TOC:

1. Establish TOC consciousness in the program
2. Establish an R-TOC baseline and identify TOC drivers
3. Develop a TOC reduction strategy
4. Manage R-TOC within the program
5. Establish R-TOC goal, objective and threshold
 - a. Establish meaningful R-TOC metrics
 - b. Identify and quantify R-TOC initiatives
 - c. Track implementation of R-TOC
 - d. Measure results against the plan

R-TOC can be implemented by programs at all stages in the acquisition process, but the approach may be quite different, depending on where the program is in the life cycle. Solutions that may be relatively easy to design into a new system may be impossible to implement in a fielded system, which already has a finished design and an established logistics support system. On the other hand, fielded systems provide a real experience baseline so that it is possible to identify actual subsystems or processes that reduce reliability, increase O&S costs, or increase maintenance cycle time.

Reducing TOC is a continuous process, not a one-shot reporting requirement. Some Pilot Programs basically are just continuing to monitor the same set of TOC reduction initiatives that they originally developed in 1999. The programs that are most successful in reducing TOC continue to pursue funding for initiatives that were initially rejected. Others also continue to refine ongoing initiatives and develop new ones. Several of the Pilot Programs stand out for their persistence in developing new initiatives; two particular examples (the Apache and the F-16) are discussed in Sections 4.1.4 and 4.1.6.

AWACS pointed out how important it is for R-TOC planning to be reflected in every task performed by the program office: "R-TOC initiatives have been integrated into AWACS corporate decision making processes (requirements generation, acquisition program baselines, planning, programming and budgeting system (PPBS). The alignment of personnel and the evolution of the day-to-day process are part of AWACS continued

R-TOC commitment. R-TOC has become a “team” effort in AWACS, with every facet of the program thinking cost savings.”

JSTARS stressed the importance of involving the entire team, including users and the contractor, in developing R-TOC plans: “Every segment of the program must take ownership and be responsible for integrating the R-TOC Process: The Joint STARS ‘Core Team’ is responsible for implementing the R-TOC program.” The JSTARS ‘core team’ “consists of representatives from the Air Combat Command (ACC), 116th Air Control Wing (ACW), Northrop Grumman Corp. (NGC), and the Program Office. ‘R-TOC ‘Champions’ are selected within each IPT to lead and facilitate cost reductions and cost estimates. They serve as the key IPT interface with the Core Team.”

The C/KC-135 described how continuing investigation of R-TOC opportunities within the program helped identify additional cost savings opportunities:

“The visibility that the R-TOC program gives to high cost drivers continues to bear fruit. A recent investigation of our high cost driver list revealed that because of repetitive nomenclature, there is a ‘displacement gyroscope’ that could easily be mistaken for an Interchangeability and Substitutability match for one of the Pacer CRAG displacement gyroscopes. ... Continued research revealed that the gyroscope was not associated with Pacer CRAG [but] the item is still high cost and needed to be reviewed for cost saving possibilities. [It] has now become a new R-TOC initiative [and] we are now looking at a COTS replacement with a projected 20 times improvement in MTBF at a projected cost increase of only 30 percent.”⁵

2.1.1 R-TOC and Acquisition Programs

In some ways, programs in the development or acquisition process have more latitude to implement R-TOC than fielded systems. Because the system still is in production, it is possible to “design in” capabilities that improve reliability or reduce TOC. Especially for relatively large programs, the program office has personnel and financial resources for systems engineering (which can be severe constraints for fielded systems).

Because the program does not have an existing structure of bases and depot support, the program manager generally has more latitude than the manager of a fielded system to define the most appropriate product support strategy and to take steps to create an effective and responsive supply chain. (Tables 2-1 and 2-2 show R-TOC actions taken by the Pilot Programs in the development or acquisition process.)

⁵ C/KC-135 R-TOC Pilot Program Quarterly Progress Report, October 2001.

Table 2-1. Pilot Activities in Development and Production

R-TOC Initiative/System	Comanche	ITAS	UAV Sys	AAAV	LPD-17	MTVR	SLAM-ER	C-17	JSTARS
R&M Improvement									
Design to O&S cost (DTOSC) target	X		X	X	X	X			
Design for producibility, design for reduced O&S	X	X	X	X	X	X	X	X	
ID/replace high cost/low MTBF components		X		X	X		X		X
Development of metrics/assessment tool				X	X				X
COTS/NDI, commercial buying practices	X			X	X	X	X	X	X
Contractor incentives to reduce TOC		X					X	X	X
Supply Chain Response Time/Footprint Reduction									
Built in diagnostics	X			X	X				
Digitized tech orders/IETMs	X			X					
Reliability centered maintenance/condition based maintenance				X					
Two-level maintenance (elimination of I-level)							X		
Reduced depot maintenance workload					X	X			
Integrated data environment					X				
Competitive Product Support									
Life cycle support study/depot source of repair analysis	X		X	X	X			X	X
Contractor logistics support/life cycle support		X	X			X		X	X
Performance-based logistics	X	X	X	X	X	X		X	X

Table 2-2. R-TOC Pilots Actions of Development and Fielded Systems

R-TOC Initiative/System	FSC2	Precision Fires	ASE	H-60	CCIC2S	SBIRS
R&M Improvements						
Retire and consolidate legacy systems	X	X	X	X	X	X
Recapitalization/major mod and upgrade		X	X			
ID/replace high cost, low MTBF components		X	X	X		X
Reduce soldier/sailor workload	X	X			X	X
Corrosion resistance/mitigation				X		
COTS/NDI, commercial buying practices	X	X	X		X	X
Contractor incentives to reduce TOC			X		X	
Supply Chain Response Time/Footprint Reduction						
Improved supply chain responsiveness, including direct vendor delivery	X	X	X	X		
Digitized tech orders/IETMs				X		
Commercial maintenance agreement			X			
Deploy Automatic Information Technology (AIT)/track parts		X				
Reliability centered maintenance			X	X		
Competitive Product Support						
Maintenance/sustainment assessment tool/decision support system		X				
Performance base logistics feasibility study		X		X		
Contractor logistic support/life cycle support					X	

Examples of R-TOC initiatives pursued by programs in development or acquisition include:

- Design to O&S Cost (DTOSC)
- Development of a Cost Reduction Integrated Product Team (CRIPT) to coordinate cost reduction strategies
- Apply lessons learned from other programs
- Develop optimum strategy and structure for life cycle support (see Section 2.2.2 and 2.2.3 for discussions of Total Life Cycle Systems Management (TLCSM) and Performance Based Logistics (PBL))

All new programs are required to perform cost-performance tradeoffs under Cost as an Independent Variable (CAIV) (see Section 2.2.1). To ensure that all TOC reduction opportunities are considered, the PM should be sure to include O&S costs as well as production costs in CAIV tradeoffs.

The LPD-17 amphibious transport dock is one Pilot Program with a particularly strong production-phase R-TOC activity. The LPD-17 has identified the following “Lessons Learned” for TOC-conscious design:

- Identify cost drivers (manning and maintenance for LPD-17)
- Identify a realistic stretch goal
- Create a TOC conscious environment
- Create TOC avoidance plan and process
- Balance O&S cost avoidance/savings and design/production cost control incentives
- Create government-industry team
- Validate design changes with warfighter

Some of the LPD-17’s conclusions show the importance of modifying the approach to R-TOC as circumstances in the program change. The program office reported that:

“Early in the program, the TOC emphasis was on “designing” in supportability, e.g., improved reliability and maintainability, and using an Integrated Product Data Environment to automate labor intensive operations. Today the program is developing a life cycle support strategy based on a long-term partnership with industry, which has potential to further reduce O&S cost. ... The program manager’s Affordability Cost Candidate (ACC) Program, a joint government/industry effort designed to improve acquisition cost performance, continues to identify potential cost avoidance proposals. There have been over 367 potential affordability cost candidate suggestions reviewed by the government/industry management

team, with 14 of the ACC's currently going through the detailed review stage and 65 of the ACC's have been placed on contract.”⁶

2.1.2 R-TOC and Fielded Systems

Fielded systems face a number of limitations in their approach to R-TOC. Because the system has already been designed, developed and produced, it is not possible to “design in” TOC reduction initiatives. After production has ended, the principal funding for the system usually comes through Operations and Maintenance (O&M) accounts, which are usually controlled by the user rather than the PM. In addition, the PM normally has a source of funding for sustaining engineering for systems that are still in production, but this type of funding may become much more difficult to obtain once the system is fielded. (Tables 2-3 and 2-4 show R-TOC actions by fielded systems.)

Because the systems are deployed in the field, the PM may have only limited access to the fleet. Even if funding can be obtained to develop TOC reductions, it may only be possible to install them when the system undergoes depot maintenance. For many fielded systems, a major modification may be the only practical opportunity to implement some R-TOC initiatives.

These challenges can be even greater for PMs for Low Density/High Demand (LDHD) systems, which include a number of R-TOC Pilot Programs. LDHD systems are considered:

“Force elements consisting of major platforms, weapons systems, units, or personnel possessing specialized attributed or capabilities, which have historically been called upon by [theater commanders] to execute worldwide joint operations at a rate that degrades their near- to mid-term readiness. There is no universal formula to determine which assets should be considered LDHD. It is important to note, however, that the primary differentiating characteristics of these assets are their unique joint mission capabilities and an unusually high demand by [theater commanders] (relative to the availability of the force).”⁷

The demands on some of these systems can be staggering. For example, because of pressing requirements to support drug interdiction missions, Operation Enduring Freedom, and other operations, the 552nd ACW, which flies the Air Force's AWACS aircraft, flew 170 percent of its scheduled flying hour program in FY02. With such a high level of operational commitments the program will often focus more on day-to-day maintenance to keep the systems flying while ignoring longer-term system improvements. Another difficulty in implementing R-TOC in LDHD systems is that the relatively small number of systems reduces the potential payback from implementing system improvements. The basic engineering of a new or improved component tends to be similar, whether there is a fleet of thousands or only a few dozen in which to install the improvement.

⁶ LPD 17 R-TOC Pilot Program Quarterly Progress Report, 13 February 2003.

⁷ Airborne Warning and Control System (AWACS) R-TOC Pilot Program Quarterly Progress Report, August 2002.

Table 2-3. R-TOC Actions by Fielded Systems (Army and DoN)

R-TOC Initiative/System	Apache	Abrams	CH-47	GRCS	HEMTT	Aegis	Common Ship	CVN-68	EA-6B
R&M Improvements									
Recapitalization/major mod and upgrade	X	X	X		X			X	X
ID/replace high cost, low MTBF components	X	X	X	X	X	X	X	X	X
Reduce soldier/sailor workload		X	X	X	X	X	X	X	
Reduce fuel consumption		X			X	X	X		
DMSMS or high consumption parts database			X	X			X		
Corrosion resistance/ mitigation			X		X		X	X	X
Emphasis on sustainment engineering		X		X		X	X	X	X
Development of metrics/assessment tool	X		X		X	X	X		
COTS/NDI, commercial buying practices			X		X	X	X	X	X
Contractor incentives to reduce TOC	X	X							
Supply Chain Response Time/Footprint Reduction									
Improved supply chain responsiveness, including DVD		X		X	X				X
DLA/supplier alliance		X			X				
Digitized tech orders/IETMs			X		X				
Reliability centered maintenance									X
Embedded diagnostics		X			X				
Integrated data environment						X			
Competitive Product Support									
Performance based logistics support	X	X	X	X					
Government-industry logistics support partnership	X	X		X					

Table 2-4. R-TOC Actions by Fielded Systems (Air Force)

R-TOC Initiative/System	AWACS	B-1	C-5	C/KC-135	F-16	F-117
R&M Improvements						
Recapitalization/major mod and upgrade	X	X	X	X	X	X
ID/replace high cost, low MTBF components	X	X	X	X	X	X
Reduced soldier/sailor workload						X
Reduced fuel use		X				
DMSMS database	X					
COTS/NDI, commercial buying practices		X	X	X	X	X
Contractor incentives to reduce TOC			X	X	X	X
Improved diagnostics	X		X	X	X	
Supply Chain Response Time/Reduced Footprint						
Improved supply chain responsiveness, including DVD	X		X		X	
Industrial Prime Vendor/Virtual Prime Vendor (IPV/VPV)			X	X	X	
Digitized tech orders/IETMs	X	X	X	X	X	
Reliability centered maintenance						
Reduced depot maintenance workload		X	X	X	X	X
Lean initiatives			X			
Competitive Product Support						
Contractor logistics support/life cycle support						X
Depot/private sector partnerships					X	X

R-TOC initiatives can also be constrained by the fact that the support infrastructure has been developed. For example, it is probably easier to propose a contractor logistics support (CLS) approach or a private-public partnership for a new system that has not already developed a depot maintenance infrastructure. Once the infrastructure is in place, it can be very difficult to propose changes. (See Sections 2.2.2 and 2.2.3 for discussions of TLCSM and PBL.)

One advantage fielded systems have in developing R-TOC initiatives is that they can use actual performance results to develop their proposals. One typical approach of fielded systems is to identify the O&S cost drivers and principal readiness degraders. While a major upgrade may be impractical, replacement of one or a handful of key obsolete or poor-performing subsystems can make a significant difference in system readiness.⁸

Supply chain improvements represent an important way for fielded systems to reduce TOC and improve performance. While the PM of a fielded system inherits a supply chain that is already in place, there are many things a PM can do to improve the responsiveness and reduce the cost of his system's supply chain. A set of contracting arrangements, such as industrial prime vendor (IPV), virtual prime vendor (VPV), direct vendor delivery (DVD), and commercial maintenance agreements (described in Section 4.5 of the Guide) can reduce inventories and customer wait times. Other initiatives, such as reliability centered maintenance, condition based maintenance, and development of interactive electronic technical manuals (IETMs) can make the maintenance process much more efficient. Often, these types of improvements can be made without large upfront investments and without requiring access to the entire fleet.

2.2 R-TOC and Other DoD Initiatives

R-TOC's goals (improved readiness, reduced logistics cycle time, reduced O&S costs) are mutually supportive with the goals of a number of other DoD initiatives, including: Cost as an Independent Variable, Value Engineering, Total Life Cycle Systems Management, and Performance Based Logistics. This section discusses how R-TOC relates to these companion initiatives.

2.2.1 R-TOC and Cost As an Independent Variable (CAIV)

Cost as an Independent Variable (CAIV) is a methodology for reducing TOC and improving performance. It involves developing, setting, and refining aggressive unit production cost objectives and O&S objectives while meeting warfighter requirements. It is essential to involve the user community in the tradeoff process from the beginning to achieve the best outcome for all parties involved. But like any good investment, applying CAIV will not be free. It is necessary to invest resources in the tradeoff analyses required in the up-front requirement generation process. One of the most important aspects of making CAIV a success is investing in the training of key personnel to make sure the CAIV process is understood.

⁸ "Global Military Force Policy," quoted in "AWACS R-TOC States and the LDHD Challenge," August 2002 R-TOC Forum.

Under Secretary of Defense (AT&L) E.C. Aldridge established CAIV implementation as one of the key metrics under his first acquisition goal, “achieve credibility and effectiveness in the acquisition and logistics support process.” Under this goal, he approved a metric to require, by the end of FY02, 100 percent of defense programs to incorporate a CAIV plan and to have an evolutionary acquisition or spiral development plan in place. These plans are to be discrete parts of each ACAT I acquisition strategy and will be executed throughout the acquisition cycle and updated as necessary.

In a January 2002 memorandum, Under Secretary Aldridge instructed the R-TOC Working Group to develop DoD templates to be used by DoD program managers as guidelines to the development of these plans. These Templates are available on the R-TOC web site (<http://rtoc.ida.org>).

CAIV is applicable to all programs and throughout all acquisition phases including modifications and upgrades in the O&S phase. However, the single greatest point of leverage for CAIV to affect program requirements, TOC, schedule, and performance is at the beginning of a program’s life. By using CAIV the user and requirements communities work the requirements, cost, performance, and schedule tradeoffs first, using a small number of key performance parameters (KPPs), with the production unit cost as a real, independent, input variable. These initial estimates should be refined as the program progresses.

2.2.2 R-TOC and Total Life Cycle Systems Management (TLCSM)

Changes advocated under DoD’s Total Life Cycle Systems Management (TLCSM) initiative tie in closely with the CAIV approach to reducing TOC. ODUSD (L&MR) is working on changes in both the requirements process and the acquisition process, which would be consistent with CAIV and would promote a strong upfront focus on reduction of TOC.⁹

Currently, the acquisition system puts intense pressure on the PMs to meet three criteria:

1. Schedule (“early delivery of capability to warfighter”)
2. Cost (“no Nunn-McCurdy breaches”)
3. Performance (“meet the KPPs established in the Operational Requirements Document (ORD)”)

The result is that all other requirements and priorities tend to become secondary concerns. The absence of strong emphasis on sustainability can result in (often) unrealistic sustainment cost estimates, which in turn can lead to chronic underfunding of operations and support. This can lead to less than optimum mission capable rates, driving higher deployment quantities and creating larger deployment footprints.

The total systems approach provides in general that the PM shall be the single point of accountability for accomplishment of program objectives for life cycle systems management, including sustainment. Under TLCSM, the recommended changes in the

⁹ “Performance Based Logistics,” a briefing by ODUSD (L&MR), presented at December 2002 R-TOC Forum.

Requirements Process would define key performance parameters such that their inherent reliability and supportability criteria are part of the objective and threshold. Guidance for the acquisition process would be modified to ensure that the PM assesses the traditional acquisition metrics (schedule, cost, and performance) consistent with defined reliability and supportability criteria. If these criteria are not met, the program would not be cleared to proceed.

Several R-TOC Pilot Programs have been credited with actions that have helped demonstrate the feasibility of TLCSM, including:

- H-60: government-industry partnership; increase parts availability from 73 percent to 90 percent; “no cost” reliability improvements (50 percent increase in mean time between failure (MTBF) on FLIR)
- M-1 Abrams: partnership among PM, industry, and Army Material Command; potential of \$17B O&S cost reduction over the 30 year remaining life
- F-117 performance based contract support: support to 49th fighter wing rated excellent; all performance metrics met or exceeded; savings/cost avoidance to date >\$172M; F-117 withstood transition and overseas deployment to two locations (in Kosovo, F-117 flew 1,023 sorties with a mission capable rate of 86 percent)
- Advanced Amphibious Assault Vehicle (AAAV): PM life cycle oversight; estimated \$240M cost avoidance over life cycle; embedded training; competitive sourcing

The Precision Fires Rocket and Missile Systems (PFRMS) program office, which is developing the High Mobility Artillery Rocket System (HIMARS), is one of the first R-TOC Pilot Programs to attempt to implement TLCSM concepts. They concluded that effective TLCSM and PBL requires the ability to:

- Collect accurate, near real time data. Implementation of Advanced Information Technology (AIT) will allow the program to identify and track key components and collect supply and maintenance data in a near-real-time manner
- Assess the data and make informed decisions. The Product Support Decision Support System (PSDSS) will allow continuous analysis of data for informed decision-making and will support reliability analysis, contingency planning, analysis of alternatives, logistics footprint analysis, and TOC reduction analysis
- Have complete, accurate, real-time total asset visibility. Supply chain management will support asset visibility and will support accessibility to all needed data by all who require the data
- Fund effectively and manage execution (funds flow)

The PFRMS program office made the following comments based on its experience:

- Planning must start early to positively affect TLCSM

- All stakeholders must be part of the planning to ensure buy-in
- The total picture of Product Support is elusive and difficult to capture – few subject matter experts (SMEs)
- Impediments include: continued unwillingness to implement change, availability of investment funding, and existing DoD financial structure

PFRMS recommended establishing a pilot(s) to pursue financial transformation for Product Support and providing more training for the acquisition workforce in TLCSM and PBL concepts.

2.2.3 R-TOC and Performance Based Logistics (PBL)

According to DoD’s guidance for PBL, “PMs shall develop and implement performance based logistics strategies that optimize total system availability while minimizing cost and logistics footprint. Sustainment strategies shall include the best use of public and private sector capabilities through government industry partnering initiatives, in accordance with statutory requirements.”

Performance agreements are a critical element in implementing PBL. Generally, these agreements should:

- Define expectations of force provider
- Define a range of support requirements
- Provide the basis for negotiating support contracts
- Ensure accountability in meeting Warfighter requirements

Interim DoD PBL policy provides that the PM shall work with the users to document performance and support requirements in performance agreements, specifying objectives, outcomes, measures, resource commitments, and stakeholder responsibilities. Almost all R-TOC Pilots are implementing or considering some form of PBL initiative, as shown in Tables 2-5 through 2-7.

2-5. Army Pilots and PBL

Pilot	PBL Activities
Abrams	PBL Pilot; performance agreements with logistics support providers; Team Armor Partnership: government industry partnership for enhanced support of M1A2, with direct vendor delivery (DVD)
Apache	No current PBL activities mentioned (original proposal for Prime Vendor Support was rejected)
Comanche	Total Life Cycle Systems Management study
CH-47	Soldier Focused Logistics: series of initiatives to improve maintenance processes and fleet management
Guardrail	PBL Pilot: performance agreements with users and logistics support providers
HEMTT	Corporate contract with the Original Equipment Manufacturer (OEM); DVD provisions; DLA rate reductions
ITAS	Contractor Logistics Support (CLS) contract with incentives to meet operational readiness goals
Precision Fires	PBL studies and implementation plan
UAV Systems	PBL study and implementation plan

Table 2-6. DoN Pilots and PBL

Pilot	PBL Activities
AAAV	Condition based maintenance plus study for improved asset management and reduction of depot maintenance
Aviation Support Equipment	Commercial maintenance agreement with defined turn-around times and incentives for improved reliability
EA-6B	PBL Pilot: MOUs with various logistics support providers and users
H-60	Series of PBL initiatives for FLIR, avionics, other parts
LPD-17	Fleet introduction; IPT developing product support strategies
MTVR	CLS contract signed in September 2001

Table 2-7. Air Force Pilots and PBL

Pilot	PBL Activities
C-5	Virtual prime vendor/industrial prime vendor (IPV) to provide inventory and reduce cycle times; incentives for 100% fill rate
C-17	Flexible sustainment; directed to implement Total Systems Support Responsibility (TSSR) contract
C/KC-135	IPV to provide inventory and reduce cycle times; incentives for 100% fill rate
F-16	PBL Pilot: performance agreements with users and logistics support providers; IPV to provide inventory and reduce cycle times; incentives for 100% fill rate; Combined Life Time Support (CLTS)
F-117	Total Systems Sustainment Program with AF/contractor cost sharing on over-/under-runs
JSTARS	TSSR contract with incentives to meet cost reduction goals

2.2.4 R-TOC and Value Engineering (VE)

VE is “an analysis of the functions of a program, project, system, product, item of equipment, building, facility, service, or supply of an executive agency, performed by qualified agency or contractor personnel, directed at improving performance, reliability, quality, safety, and life cycle costs.”¹⁰

VE is the systematic effort directed at analyzing the functional requirements of systems, equipment, facilities, processes, and supplies for the purpose of achieving essential functions at the lowest total cost, consistent with needed performance, safety, reliability, maintainability and quality. VE methods can be used throughout a system’s life to simultaneously optimize system functionality and reduce cost. Contractor ideas are submitted using the Value Engineering Change Proposal (VECP) and are rewarded through the sharing of savings from the instant contract, related contracts, and future contracts. Shares are also granted to the contractor on collateral or life cycle savings.

The purpose of the VECP Program is to incentivize the contractor to propose contract modifications, which reduce cost without reducing product or process performance. Two aspects of the VECP make it unique in achieving its purpose: the requirement that the VECP result in a contract modification, and the incentive paid to the contractor for reducing costs. The Value Engineering Change Proposal (VECP) is the formal document a Contractor uses to submit a cost saving recommendation to the government in accordance with the VE provisions of their contract. A VECP must be submitted under an existing contract and must result in a change to that contract. In addition, the change must result in a reduction in the system’s life cycle cost to the Government.

For over three decades the VECP has had a notable history as an effective savings program for the Government. Countless programs have used the VECP to reduce cost and improve both product and process. Most authorities concede that Value Engineering is an

¹⁰ As defined in the Office of Federal Procurement Policy Act (Title 41 U.S. Code, Section 432).

excellent program but its use has waned in recent years due to a perceived lack of support by government agencies. During FY02, authority for the VE program was consolidated with R-TOC to provide improved focus for both programs.

Traditionally, VECs have been used most often on procurement contracts. More recently, the lower number of new acquisition systems and lower production quantities have heightened the attention paid to the sustainment of existing systems. Approximately 60 percent of the funds in the DoD's Total Obligation Authority (TOA) are in Operations and Support (O&S). Replacement systems are not being developed as often as in the past, resulting in an increase in the number of Service Life Extension Programs. Contractor Logistics Support (CLS) is being used more frequently to maintain existing systems. Manpower reductions are increasing the value of improvements in reliability and maintenance and reductions in supply requirements. Use of open system architectures is facilitating system upgrades and insertion of new technologies. The government is encouraging the contractor to develop and use commercial technologies in defense systems. Mechanisms are being sought to increase system readiness, incorporate improved technologies into existing systems to extend service life, reduce the O&S cost burden, and ensure existing systems can continue to meet developing threats. This heightened interest in the sustainment of existing systems offers an increased opportunity for use of the VEC.

In today's environment, the VEC has a vital role as one of the proven tools for reducing program cost and improving product and process performance. As one element in a more comprehensive cost reduction program, the VEC can provide system enhancements and cost reduction changes, which might not otherwise be made available to the Government. The VEC can be used at any point during acquisition but the predominant application has been and continues to be in the production and support phase of a program. On these legacy systems, the VEC remains one of the principal, established and proven tools for reducing cost and enhancing system performance, and can be an important complement to R-TOC.

3. R-TOC ISSUES

This section discusses actions taken by the R-TOC program to promote implementation of R-TOC. These actions have included:

- Identification and removal of barriers to R-TOC implementation
- Providing funds for R-TOC investments
- Exploring key R-TOC issues, such as contractor incentives, performance based contracting, and R-TOC implementation tools

3.1 Barriers

At the first R-TOC Forum he attended, in July 2001, Mike Wynne, the Principal Deputy Under Secretary of Defense (AT&L) asked the R-TOC Pilot Programs and other participants in R-TOC to identify the “Top 5 Barriers” to implementation of R-TOC. Over 60 inputs were received and compiled, and the consensus top 5 barriers were:

1. Color/year of money requirements (annual funding, limits on appropriations categories, reprogramming restrictions and thresholds, etc.)
2. Inadequate processes/tools to perform tradeoffs and measure savings
3. Lack of program capital fund/seed money
4. No guarantee that saved dollars will be used for the program that saved the dollars (need for savings reinvestment)
5. Limited PM control of program life cycle funding (including sustaining engineering)

Follow-up actions have been taken to address most of the barriers identified by the R-TOC Pilots. At its meeting on 3 December 2001, OSD’s Business Initiatives Council (BIC) endorsed a number of initiatives related to funding flexibility, including raising reprogramming thresholds, increasing flexibility of expired funds, and establishing closeout flexibility for O&M funds.

The BIC has also endorsed the concept that business reform “savings will be retained by the Services for their reallocation,” which addresses Barrier #4.

OSD addressed concerns about R-TOC seed funds by developing an R-TOC Program Budget Decision (PBD) to provide additional funds for R-TOC investments, starting in FY03. The terms of this PBD also provide for savings retention and reinvestment.

The OSD’s TLCSM and Performance Based Logistics (PBL) Support initiatives are intended to address the concerns about color of money restrictions and lack of PM control of life cycle funding.

3.2 Budgeting for R-TOC

Shortly after the R-TOC program was created, OSD issued funding guidance instructing the Services to set aside \$50M per Service per year for R-TOC initiatives. The R-TOC Working Group has monitored Service budgets to ensure that these funding targets are being met.

The effort by R-TOC Pilot programs to document unfunded R-TOC initiatives led to the opportunity in November 1999 to develop a “no offset” FY01 PBD. The Services developed specific budget justifications for a handful of key R-TOC projects. Guidelines for these projects were:

- 3:1 return on investment ratio desired
- Payback within the FYDP desired
- Additional benefits of the projects (warfighting improvements, workload reduction, quality of life, etc.) should also be documented

3.2.1 FY01 R-TOC Funding

As a result of this process, PBD-721 provided \$13M in additional R-TOC funds for FY01, which were approved (\$56.3M over the FYDP). These funds were provided primarily to R-TOC Pilot Programs. Programs receiving funding under the first increment of PBD-721 included:

Army

- CH-47, Multi-Platform Common Source Database and Improved Main Rotor Blades
- Multiple Launch Rocket System (MLRS), Tactical Proficiency Trainer
- HEMTT, Interactive Electronic Technical Manuals (IETMs)
- Blackhawk, Advanced Helicopter Transmission Lubricant

DoN

- Lightning Protection, Minehunter, Coastal (MHC) 51 Class
- Hardcoating for Laser Eye Protection
- EA-6B J52 Engine Component Improvement Program

Air Force

- B-1, Digitized Tech Orders
- F-117, Engine Build
- KC-135, Turbine Engine Monitoring System

3.2.2 FY03 R-TOC Funding

In December 2001, a second increment of funding under PBD-721 was approved, with funding beginning in FY03. This PBD was limited primarily to R-TOC Pilot Programs.

This PBD provides an additional \$22.5M in FY03 funds (with corresponding totals in the out-years). Like the previous PBD, this was a “no offset” PBD; the Services were not required to make offsetting budget reductions. Moreover, the savings from R-TOC investments will be retained and available for reinvestment. Approved FY03 funding under the second R-TOC PBD included:

Army programs

- \$3.7M MLRS position navigation unit
- \$2.1M Guardrail/ Common Sensor data link

DoN programs

- \$4.9M Radio Frequency Identification/Micro-Electromechanical Devices (RFID/MEMS) ordnance management
- \$0.3M Aviation Support Equipment stencils and marking
- \$1.1M AEGIS cruisers stern flap
- \$1.3M Common Ship magnetic couplings
- \$0.2M SH-60 fatigue crack monitors
- \$4.5M EA-6B flight control system

Air Force programs

- \$3.4M KC-135 radome replacement
- \$1.5M Aircraft engine electronic tech manuals

The working Group has also monitored Service budgets to make sure that PBD funds are properly allocated in out-year budgets and that the Services are complying with other defense guidance about budgeting for R-TOC. Funding for R-TOC improvements is provided through a wide variety of Service programs such as the DoN Cost Reduction and Effectiveness Improvement Council (CREIC), Army recapitalization and O&S Cost Reduction (OSCR) investments, Air Force Cost Savings Modernization Initiatives (CSMI), Small Business Innovative Research (SBIR) and Commercial O&S Savings Initiative (COSSI) investments.

3.2.3 FY04 R-TOC PBD Funding

In December 2002, a third increment of funding was approved under PBD-721. This funding, which will begin to flow in FY04, funds the following activities:

Army programs

- \$0.15M, Apache maintenance
- \$0.3M, aircraft windows
- \$1.4M, Apache test
- \$2.6M, Blackhawk fuel cells

DoN programs

- \$1.6M, Aviation Support Equipment generator control unit
- \$0.4M, H-60 oil analysis
- \$2.6M, H-60 weight reduction (joint)
- \$1.0M, H-60 weight reduction
- \$0.5M, H-60 flight control bolts

Air Force programs

- \$0.9M, AWACS pin point tester

3.3 Incentives

One of the central challenges faced by the R-TOC program is the development of incentives. A wide range of organizations involved in the development, production, use, and support of the system must become engaged in identifying opportunities to improve readiness or reduce logistics cycle time. Yet, normal DoD budget, requirements, and contracting practices may not provide strong incentives to program managers, contractors, users, or logistics support providers to develop ownership cost reduction measures.

It is widely recognized that the contractors may be a particularly fertile source of initiatives to improve readiness and reduce support costs and cycle time. But traditional cost-based contracts provide little if any incentive for a contractor to identify and propose cost savings measures. The R-TOC program has focused a great deal of attention on incentives. In particular, the R-TOC program is examining ways to maintain incentives for ownership cost reductions after a contractor logistics support contract has been awarded.

At the 4th Quarterly R-TOC Forum (held in November 2000), R-TOC Pilot Programs shared their experiences with incentives and discussed lessons learned that may be more widely applicable. Incentives discussed included award term contracts, the threat of recompetition, and a variety of measures to share cost savings. Subsequently, at the 8th Quarterly R-TOC Forum (November 2001), Pilots were asked to address incentives under sole source arrangements.

DoD has issued an Incentives Guide¹¹, which provides policy guidance on the use of incentives, discusses why they are of interest to DoD, and describes various types of incentives. Much of the Guide is directly relevant to the R-TOC program. The Guide states that:

“Suppliers should be rewarded for adopting business processes and principles designed to reduce costs and cycle time while maintaining schedule, achieving performance expectations, and maximizing efficiency. DoD business strategies should focus on the overarching business

¹¹ Incentive Strategies for Defense Acquisitions, DAU Press, 2001.

considerations related to each acquisition strategy and address the following objectives:

- *Use incentives tailored to the specific business case to achieve maximum benefit for both parties*
- *Assess the most critical issues related to specific acquisitions and design incentives to ensure optimal results*
- *Design strategies to reflect an understanding of the business case from industry's perspective. Profit, earnings per share, cash flow, and return on investment are important industry considerations in entering into business relationships*
- *Recognize and reward contractors that strategically focus on efficient and effective management practices, thereby reducing unneeded capacity and maximizing overall value to the customer (e.g., lean industry practices and best practices should be recognized and rewarded*
- *Recognize that a requirement's structure drives business solutions*
- *Match the essential program objectives and potential incentive arrangements early on, and communicate objectives to industry*
- *Agree on incentives and remedies to ensure successful business relationships¹²*

3.4 Performance Based Pilots

In their R-TOC Forum briefings, quarterly reports, and discussions at PEO/SYSCOM Commanders' conferences and workshops, R-TOC Pilot Programs have been consistent in identifying a number of barriers to further improvements. These have included: mismatches in flexibility, visibility and accountability for budget funds; lack of clear objectives and performance criteria between Program Managers and users; and lack of clear objectives and performance criteria with organic providers of product support.

In October 2000, OSD designated four R-TOC Pilot Programs to experiment with new product support techniques. These programs were requested to develop special implementation plans to address:

- Establishment of formal performance agreements between the program managers and their warfighter customers based on warfighter expectations and mission availability, particularly for legacy systems
- Use of program-specific formal agreements (or "contracts") with organic providers based on output and availability

¹² Ibid.

- Use of a program-specific working capital fund to pool funding sources and provide a robust financial base for the program managers to fund product support providers to meet mission availability expectations

The four Pilot Programs selected to participate in this experiment were: Abrams Tank System, Guardrail/Common Sensor, EA-6B Prowler, and F-16 Fighting Falcon. All four of these programs described their initial plans at the 5th R-TOC Forum (January 2001) and provided updates at the 8th and 12th R-TOC Forums (November 2001 and December 2002). In general, the programs have reported good progress in meeting the first two objectives, but less support for the working capital fund. Memoranda of Agreement (MOAs) have been developed with key users and existing agreements with logistics support providers are being modified to incorporate R-TOC metrics and concerns.

Based in part on the progress these Pilot Programs demonstrated in developing performance based logistics agreements, the Deputy Under Secretary of Defense (Logistics and Materiel Readiness) (DUSD/L&MR) announced a new Performance Based Logistics concept early in 2002. This concept, which is being implemented throughout DoD, was briefed at the 9th and 12th R-TOC Forums.

3.5 R-TOC Tools

Program managers attempting to identify ways to reduce the ownership cost of their system, evaluate the merits of competing total ownership cost (TOC) reduction proposals, or track their program's progress in reducing TOC face an array of obstacles. These include the lack of basic information about system O&S costs and the absence of tools to perform R-TOC tradeoffs or track cost savings.

The R-TOC Pilot Programs and other participants in the R-TOC process identified "inadequate processes/tools to perform tradeoffs and measure savings" as one of the five principal barriers to implementation of R-TOC. At the outset of the R-TOC program, Pilots found that there were few if any tools that could help them implement R-TOC. Shortfalls include tools to identify current and planned system O&S costs, perform R-TOC investment analysis and tradeoffs, and measure the impact of R-TOC savings. Identifying and improving R-TOC tools has been a principal purpose of the R-TOC program. All R-TOC Pilots were asked to identify the tools they use for various R-TOC purposes, and special presentations were made on a number of these tools at the July 2001 R-TOC Forum. Special presentations have been made on other R-TOC tools periodically since then.

Some of the tools developed especially for R-TOC Pilots or adapted for use in tracking TOC reductions include:

O&S Cost and System Reliability Tools

- Naval Center for Cost Analysis (NCCA) Tools
- Air Force Total Ownership Cost (AFTOC) system
- Advanced Maintenance Aid Concept (CH-47)
- Product Support Decision Support System (PFRMS)

- O&S Cost Analysis Model (OSCAM) (developed by NCCA, adapted by AAV)

R-TOC Investment Tradeoffs and Performance Tracking

- JSTARS Cost and Performance System (J-CAPS)
- Apache Recapitalization Model (Apache)

Many of these tools are described in more detail in Section 4.2 of this Guide.

4. R-TOC BEST PRACTICES

The designation of 30 programs as R-TOC Pilot Programs was expected to have several beneficial impacts on ownership cost growth. The 30 Pilot Programs represent a significant fraction of the total DoD inventory of systems, and any ownership cost reduction initiatives (CRI) accomplished by the Pilot Programs will contribute directly to reducing DoD ownership costs.

However, the R-TOC Working Group has recognized that the real benefits of R-TOC can only be achieved if all DoD programs are enlisted in the effort to reduce ownership costs. Therefore, an even more important purpose of the Pilot Programs is to document what works and share this information with other DoD programs that are not R-TOC Pilots. This chapter describes some successful R-TOC initiatives.

The best practices are organized in six sections. The first three sections describe innovative practices in the area of R-TOC management (Section 4.1), discuss some innovative efforts by Pilot Programs to develop new R-TOC assessment tools (Section 4.2), and describe acquisition practices that can help reduce TOC (Section 4.3). The last three sections present best practices in the three primary R-TOC focus areas: reliability and maintainability improvements (Section 4.4), supply chain response time improvements and footprint reduction (Section 4.5), and competitive product support (Section 4.6).

4.1 R-TOC Management

4.1.1 Coordination of R-TOC Initiatives [Pilot Programs: AEGIS Cruisers, Common Ship, CVN-68 Carriers, LPD-17]

INITIATIVE: Four of the DoN's R-TOC Pilot Programs are primarily concerned with reducing ship ownership costs. Collectively, these four Pilot Programs address most surface ship types in the Navy, including legacy systems (Common Ship, AEGIS Cruisers, CVN-68 Carriers) and ship types that are still in design or production (CVN-68 Carriers and LPD-17). Although the ownership cost issues are different for each ship type, the projects are making efforts to ensure that ideas developed by one Pilot Program are implemented widely.

PEO Theater Surface Combatants (TSC) (AEGIS Cruisers) was given direction and the lead by the Smart Fleet Executive Steering Council to reinstate the Smart Fleet Innovation Technology Cell for the purpose of coordinating workload (and TOC reduction) efforts. The Innovation Cell has been created and is focused toward collaboration among the Fleet, other Navy Programs and activities. Its purpose is to evaluate new workload reducing, beneficial, enabling technologies and/or processes for implementation. Fleet participation has assisted in identifying accompanying DoN policy and procedural changes necessary to maximize utilization and imbed the innovations.

The Common Ship team meets regularly with other DoN R-TOC teams and has briefed the Smart Fleet Innovation Team.

PM, Aircraft Carrier Program (PMS-312) and PM, Future Carrier Program (PMS-378) have planned a combined Program TOC Summit. This initiative is focused on determining how best to combine program efforts to leverage resources more efficiently and eliminate duplicate efforts. The summit provides the PEO Carriers Program Offices a chance to better define high cost drivers and to identify new technology initiatives that can be back fit into CVN-68 Class carriers to reduce TOC. Further, analysis of actual R-TOC initiative return cost data and operational data from in-service aircraft carriers is of significant value to the Future Carrier Program as they work to improve the design of future carriers.

BENEFITS: The LPD-17 team has incorporated many of the concepts developed by other R-TOC teams, including Advanced Food Service, Integrated Bridge System, and other initiatives developed by “Smartship” and other R-TOC initiatives. Similarly, new initiatives developed in the CVN-68 Carriers and other Pilot Programs are being carried forward to future carrier designs.

4.1.2 Coordination of Legacy and New Systems [Pilot Program: Fire Support C2]

INITIATIVE: In June 2000, the former Advanced Field Artillery Tactical Data System (AFATDS) pilot program was redefined and renamed the Fire Support Command and Control (FSC2) pilot program. The objective of this initiative is the integrated life cycle management of AFATDS, the Forward Entry Device (FED), the Lightweight FED (LFED), Fire Support C2 Legacy Systems, and the Advanced Deep Operations Coordination System (ADOCS) with cost effectiveness as the top priority. The Commanding General of the Army Communications and Electronics Command (CECOM) and the PEO for Command, Control, Communications, and Surveillance (C3S) have signed a formal memorandum of agreement (MOA) with the goals of reducing O&S Costs for Army Fire Support C2 and integrating life cycle management of AFATDS and Fire Support C2 legacy systems.

BENEFITS: Since a single Combat Development organization managing both the Acquisition and Legacy Fire Support C2 Requirements, both Program Manager (PM) Field Artillery Direct Support (FATDS) and CECOM continues to realize the benefits of improved synchronization and avoidance of potential duplicative software functionality.

4.1.3 Remanufacture and Replacement of Legacy Systems [Pilot Program: H-60]

INITIATIVE: The cornerstone of the Navy’s Helicopter Master Plan (HMP) [supplanted in September 2002 by the Chief of Naval Operations Concept of Operations, or CONOPS] calls for replacing a number of aging helicopter systems with a total of 241 new MH-60R aircraft that provide enhanced mission capabilities and reduced O&S costs. This R-TOC approach has been modified on a number of occasions. The original R-TOC plan assumed that 243 SH-60Bs and SH-60Fs would be remanufactured into SH-60Rs; the Navy has since decided to build new MH-60Rs rather than remanufacture.

The cycle time from start of the MH-60S program to first aircraft in the fleet was only two years, and the total time from program start to initial operating capability (IOC) was only four years. Development costs came in at less than the \$72M Milestone II Acquisition Program Baseline (APB).

The Navy ultimately will replace seven types of helicopters (including various H-60 models plus the UH-3H, CH-46D, and HH-1N) and many of the S-3B aircraft missions as well, with two Blackhawk systems (MH-60R and MH-60S). System improvements include common avionics and software, a variety of obsolescence initiatives, an integral Health Usage Monitoring System (HUMS), and extensive built-in test with IETMs. The program office has also developed a number of reliability improvement and cost avoidance initiatives via the CREIC or the R-TOC PBD processes.

BENEFITS: The H-60 program office estimates that long-term O&S savings from the implementation of the CONOPS will exceed 35 percent of the “as is” baseline.

4.1.4 Replacement of Original R-TOC Initiatives [Pilot Program: Apache]

INITIATIVE: The Apache helicopter’s original R-TOC plan involved a well thought out and potentially important proposal for Prime Vendor Support (PVS). The proposal envisioned a five-year firm fixed price (FFP) contract for “power by the hour,” with annual renewal options. The contract would have incentivized the contractor to reduce customer wait time and provide a more reliable parts supply. After prolonged discussion, the Apache PVS proposal was rejected within the Army, primarily because of the adverse impact it would have on the Army Working Capital Fund (AWCF), leaving Apache with no documented R-TOC activities.

The Apache program office showed great flexibility in the aftermath of the rejection of their original R-TOC plan. Within two years, the program office had: assigned R-TOC responsibility to the O&S IPT; identified O&S cost drivers; campaigned for funding through programs such as Supply Management, Army/O&S Cost Reduction (SMA-OSCR), COSSI, and VE; developed a recapitalization (recap) baseline and recap/remanufacture program; commenced development of a recap data system; and developed a variety of reliability and safety initiatives.

BENEFITS: The initiative shown by the Apache Pilot Program in redefining a new R-TOC approach has yielded significant benefits. The Apache projects a total life cycle O&S cost saving from R-TOC investments in excess of \$2.2B, a considerable improvement over the Pilot Program’s situation two years ago, when it reported that its only R-TOC initiative had been rejected.

4.1.5 Developing TOC Conscious Culture [Pilot Program: B-1]

INITIATIVE: General Joseph W. Ralston, former commander of Air Combat Command and current commander, U.S. European Command and Supreme Allied Commander Europe, has observed that “B-1 cost of ownership is more threatening to the aircraft than the enemy.” The team organized teams to control O&S costs as early as the mid-1990s and formed a red team in 1997 to help understand the causes of a projected \$600M O&S

increase over the FYDP, to organize B-1 TOC reduction efforts, and to institutionalize and educate the B-1 community about cost reduction processes.

The B-1 was one of the first USAF programs to form a Cost Reduction Integrated Product Team (CRIPT) and was a major contributor to the development of the Air Force R-TOC template and the AFTOC process. The mission of the CRIPT is to document, track and champion cost reduction initiatives and to perform analyses based on R-TOC guidelines. Participation involves the entire B-1 community, including representatives of the user and the contractor.

BENEFITS: In the past decade, the B-1 has undergone several capability upgrades and has successfully transitioned from a low altitude bomber with primarily a nuclear deterrence mission to a high altitude conventional platform with in-flight mission planning capability. First used in Kosovo, the bomber attained a 73 percent mission capable (MC) rate, a number that improved to 80 percent during Operation Enduring Freedom. Of 100 R-TOC initiatives considered, 25 have been or are being implemented, with FY05 savings exceeding \$600M.

4.1.6 Continuing Efforts to Develop R-TOC Initiatives [Pilot Program: F-16]

INITIATIVE: The F-16 Pilot Program provides one of the best illustrations of the importance of viewing R-TOC as a continuing process, rather than a one-time reporting requirement. Managing TOC is particularly complex for this program because of the quantity and complexity of the inventory (over 4,000 aircraft, in 12 major blocks, were purchased by 19 countries).

Life cycle costs for the system are growing. In coordination with users, contractors, and others, the program office has undertaken continuing assessments and refinements of high cost drivers. Though there are limited upfront investment funds, potential new R-TOC initiatives are still being studied. Because of the volume of continuing international sales, the F-16 is somewhat unique in the sense that many of the opportunities for TOC reduction initiatives come about as a result of international sales opportunities.

Currently funded initiatives are not forecast to meet the 20 percent savings goal for FY05 (although the F-16 fleet is so large that even the 3.6 percent currently forecast represents a lot of money.) The F-16 SPO and various other stakeholders “allocated” the 20 percent goal among themselves and progress toward the goal is being tracked by the various organizations. This provides strong enterprise-wide motivation to identify ways to reduce O&S costs and ensures that all stakeholders will be involved in the process.

The essence of the F-16 R-TOC strategy is to identify cost drivers, document potential cost reduction initiatives, and obtain funding; continue to grow the R-TOC philosophy across the entire F-16 team; and seek international cooperation efforts to support mutually beneficial R-TOC initiatives. Six separate organizations (including the SPO and three Air Logistics Centers) have sponsored 26 separate R-TOC initiatives.

BENEFITS: The program office's persistence has resulted in development approval and funding of new R-TOC initiatives. In August 2000, projected FY05 savings totaled only \$20.1M; this estimate has grown to \$65.5M, and life cycle savings exceed \$1.5B.

4.2 R-TOC Tools

4.2.1 JSTARS Cost and Performance System (J-CAPS) [Pilot Program: JSTARS]

INITIATIVE: Under the JSTARS Total Systems Support Responsibility (TSSR) contract, Northrop Grumman is responsible for developing the J-CAPS system to provide the analysis tools, data, and products to manage and track the performance of the Joint STARS support system. J-CAPS functions will include:

- Data warehousing of current financial and performance data in order to produce J-CAPS reports and tracking information and provide a single point data system for external reporting and information needs
- Marginal analysis for assessing budget adds/cuts
- Budget planning
- Analysis of R-TOC proposals

System requirements for the J-CAPS have been defined and the basic architecture has been developed. J-CAPS consists of an integrated data repository that hosts a comprehensive assortment of system performance and cost data, linked to a series of established models and tools to effectively assess and analyze system sustainment. Tool sets include the Logistics Composite Model, the Automated Cost Estimating Integrated Tools software, Monterey Activity Analytical Platform, and the Total Cost Delta model. When complete, the J-CAPS system will operate across the entire JSTARS structure, including the program office, contractor, and user. Initial operating capability was achieved in February 2002, with full capability scheduled to be provided by May 2003.

BENEFITS: Besides tracking the impacts on the program of R-TOC proposals and budget decisions, the J-CAPS will provide a capability to analyze R-TOC alternatives and help in setting annual contract performance targets.

4.2.2 Advanced Maintenance Aid Concept (AMAC) [Pilot Program: CH-47]

INITIATIVE: The Cargo Helicopters PM Office (PMO) is looking into innovative ways of managing its weapon systems. The Advanced Maintenance Aid Concept (AMAC) is being developed to operate in an operational field environment in order to understand and address technological, process, and cultural issues necessary for achieving key goals of the Cargo Helicopter's Life Cycle Management Program. AMAC is an electronic maintenance management system that integrates technical data, data collection, and training into a single user-friendly system. It is an organizational tool to provide maintenance tasks to the soldier-mechanic in a work package format. It uses a point-and-click interface to replace current paper-based maintenance guides, references, and log books. Under AMAC, essential maintenance data is kept in a central database and

transmitted to the AMAC system at the user location. AMAC assembles the data into a “card” format, and the maintainer documents his actions via the electronic card. This enables the user to maintain centralized reliability and repair information, which can be used by the PM, the user, the OEM, and others for planning and identifying systemic problems.

BENEFITS: The goal of the AMAC Program is to develop a maintenance tool and data collection system for the CH-47 that is part of an overall life cycle management approach designed to reduce O&S costs. The system will reduce soldier workload, enhance training, and allow the PM and the user to evaluate system performance. The system is also considered highly adaptable to other systems and has been exposed to most of the other Army R-TOC Pilot Programs.

4.2.3 Multi-Platform Common Source Database (MACS-D) [Pilot Program: CH-47]

INITIATIVE: To update more than 40 sets of legacy Tech Manuals supporting the CH-47, CECOM is converting the existing portable document format (PDF) files to editable digital format. The technical data in the IETMs will also be updated/corrected as necessary and basic IETM functionality to include the ability to print the IETMs, the ability to electronically link the RPSTL illustrations with the parts lists, and wire tracing (which electronically highlights individual wires on a wiring diagram) will be integrated as appropriate. The IETM files (in XML format) will reside in a configuration-controlled database managed by CECOM. As of the 1st quarter FY02 CECOM has awarded a task order to ISS Inc., successfully completed several test data conversions, and begun conversion of the first seven sets of MACS-D publications.

BENEFITS: MACS-D is a three-year program, from FY01-03. Regular sustainment by CECOM will resume in FY04, with cost avoidance estimated to continue at approximately \$60K per year per IETM (FY97 dollars) until the system supported is retired from use. The program will convert 43 sets of CECOM managed publications manuals used on a variety of platforms, for which a conservative life expectancy of each manual is estimated to be 10 years. The total cost (FY01-03) of the program is \$3.6 million, with an estimated total cost avoidance of 8.7 percent, based on a Logistics Information Agency (LIA) model.

4.2.4 Apache Recapitalization Model [Pilot Program: Apache]

INITIATIVE: The goals of the Apache recapitalization project are through upgrades and rebuilds of selected components and subsystems to achieve:

- 20 percent reduction in O&S costs
- 20 percent increase in Mean Time Between Unscheduled Removal (MTBUR)
- Fleet average age of 10 years by 2010

Sandia National Labs (SNL) has developed a model to assist the Apache Project Office (PMO), in assessing the Apache recapitalization Baseline Model. The developed Apache Baseline Model is populated with existing failure and maintenance data from a wide range of government and contractor data sources, including Operations and Support

Management Information System (OSMIS), the Provisioning Master Record, and Boeing reliability and maintainability information.

BENEFITS: When completed, the model will be able to predict the impacts of planned recap components and subsystems as well as other cost and availability drivers. The result will be improved data collection, reduce O&S costs, improved system reliability and availability, and reduced maintenance burden.

4.2.5 O&S Cost Analysis Model (OSCAM) [Pilot Program: AAV]

INITIATIVE: Direct Reporting Program Manager (DRPM) Advanced Amphibious Assault (AAA) has a requirement for a robust cost tool to understand, maximize, and manage the impacts of various life cycle support strategies. The program office decided to develop its own customized module from the Naval Center for Cost Analyses O&S Cost Analysis Model (OSCAM). OSCAM uses systems dynamics techniques (influence diagrams) to evaluate life cycle alternatives.

BENEFITS: For an investment of less than \$1M, the program office will obtain a strategic decision-making tool for evaluating AAV's future product life cycle support plans. Verification & validation of the model is in process. The model is expected to be available for evaluating potential cost reductions in FY03.

4.3 Acquisition Practices

4.3.1 Multi-Year Procurement [Pilot Program: C-17]

INITIATIVE: The C-17 multi-year procurement strategy incorporates a number of innovative features including performance based financing and a team approach with the Government, the contractor, and key suppliers working to develop a joint cost model and to identify cost reduction opportunities.

BENEFITS: Overall, the stability and economic advantages of this multi-year approach reduced the C-17 program's contract cost by 5.5 percent over an annual buy contract strategy (based on a \$14.2B 7-year multi-year contract for 80 aircraft). In addition, the production stability afforded by multiyear contracting has allowed the prime contractor to deliver new aircraft consistently more than four months ahead of schedule.

4.3.2 Commercial Acquisition Practices [Pilot Programs: Various]

INITIATIVE: A variety of Pilot Programs are experimenting with commercial acquisition practices.

- Precision Fires is evaluating price-based acquisition for the HIMARS
- SLAM-ER has instituted a lean enterprise strategy to reduce lead time and improve affordability and delivery
- AWACS is considering commercial supply chain management strategies to reduce inventory costs and lead times
- F-117 is examining web-enabled purchasing and commercial contracting to reduce lead time and stabilize parts supply

While the use of commercial processes and technologies has undoubtedly been accelerated by the R-TOC program, several of the systems designated as R-TOC Pilots have been engaged in adapting COTS/NDI capabilities for many years. At least six of the Pilot Programs (HEMTT, MTVR, SLAM-ER, AWACS, C/KC-135, and JSTARS) were originally adapted from COTS or NDI systems and components.

BENEFITS: When applied correctly, these can reduce the time required for contracting, design, and production; reduce costs; and expand the pool of companies willing to bid on the project.

4.3.3 Must-Cost [Pilot Program: C-17]

INITIATIVE: The C-17 Must-Cost program is a collection of contractor-funded cost reduction initiatives. The contractor is authorized to invest money for these initiatives over four years with no increase in the multi-year production targets. Under this arrangement, the Air Force agreed to pay back the investment over four years, with payback delayed by one year from investment. Must-Cost initiatives address design and process changes, technology insertion, reductions to overhead, and optimized multi-year contracts with suppliers.

BENEFITS: Through June 2001, a total of 126 approved must-cost initiatives have resulted in \$418M in savings/cost avoidance, for a 2.7 to 1 return on investment for the C-17 program.

4.3.4 Economic Order Quantity (EOQ) [Pilot Program: Standoff Land Attack Missile – Expanded Response (SLAM-ER)]

INITIATIVE: SLAM-ER was planned from inception to reduce development, production, and O&S costs. Steps taken during development included maximize non-development items (NDI) and COTS; documentation streamlining; reduced parts count; 53 percent reduction in government maintained drawings; and an incentive fee contract. Production savings were achieved through: performance specifications; contractor configuration control; twelve-month procurement leadtime; and use of LRIP to sustain production line.

The TOC profile for the SLAM-ER system is atypical for weapon systems, with 47 percent of life cycle costs accounted for by procurement and only 28 percent resulting from O&S. Consequently, TOC reductions are heavily dependent on acquisition cost savings. The PM has suggested increasing the procurement rate to an economic quantity since the program's inception as a Pilot Program.

Initially, the annual procurement rate was reduced to 20 percent of the plan, which increased procurement costs by 83 percent. Eventually, the plan was revised to buy out the requirement from FY03-05, with major unit cost reductions resulting from this decision.

BENEFITS: Shortening the production run resulted in total FY06-12 savings of \$75.5M.

4.3.5 Evolutionary Test and Evaluation [Pilot Program: SLAM-ER]

INITIATIVE: SLAM-ER capabilities will be improved periodically, primarily via software rapid acquisition with demonstrated technology. The program office recognizes

that commercial-specification parts internal to SLAM-ER (e.g., electronics components) will become obsolete and therefore change over time.

SLAM-ER will continue to be procured to a performance specification. The traditional testing approach has a number of disadvantages: it requires “batches” of missiles to evaluate changes or improvements to a weapon system, it requires a cost prohibitive quantity of assets to create a statistically significant sample size it provides no path for demonstration and accelerated IOC of innovative design and employment concepts, and it treats “evolutionary” approaches as “non traditional.”

SLAM-ER’s initiative will perform collaborative follow on test and evaluation (FOT&E) in conjunction with development testing (DT) of future improvements (seamless use of DT/operational testing (OT) data). This approach maximizes the data set for system evaluation, allowing the program to “gather data once, use many times.”

BENEFITS: The principal benefit of this approach is that it will reduce T&E costs and schedule.

4.4 Reliability and Maintainability (R&M) Improvements

4.4.1 Government-Industry Partnership to Improve Engine Reliability [Pilot Program: Abrams Tank System]

INITIATIVE: The Abrams Tank System has developed several innovative government-industry partnerships to improve R&M. The first of these is the Partnership for Reduced O&S Costs, Engine (PROSE) initiative to rebuild the existing AGT 1500 tank engine. PM Abrams, the Army Tank and Automotive Command (TACOM) (Anniston Army Depot), and Honeywell have implemented this partnership in order to reduce the number of players, provide management focus, and help incorporate best commercial practices and performance specifications. Under PROSE, Honeywell is responsible for program/project management and project engineering, customer support, supply chain management, field service engineering, and quality assurance. TACOM has responsibilities for repair and overhaul, testing, failure analysis, and sustainment management.

BENEFITS: The PROSE process is expected to improve reliability by 30 percent. The potential benefits of deploying a new engine (which is now under development) are much more dramatic – the Army could achieve a 4-5 fold improvement in reliability, hopefully a 35 percent reduction in fuel consumption, a 42 percent reduction in the number of parts, and a 15-20 percent improvement in vehicle mobility. Life cycle engine O&S costs are projected to drop from 16 billion dollars over 30 years with the current engine to 3 billion dollars with the new engine.

4.4.2 Government-Industry Partnership for Tank Overhaul [Pilot Program: Abrams]

INITIATIVE: The Abrams Integrated Management (AIM) is an innovative partnership between Anniston Army Depot (ANAD) and General Dynamics Land Systems (GDLS) to rebuild M1A1 tanks (the oldest Abrams models) to original factory standards, applying all Maintenance Work Orders (MWOs). The tanks are disassembled and inspected at

ANAD and are re-assembled by GDLS. Although the tanks are delivered in “like new” condition, they still operate with 1980s technology. However, the AIM also provides a cost-effective opportunity for selective upgrades. Upgrades being installed include revised turret and hull networks boxes, intercom, and a digital electronics control unit.

BENEFITS: The overhauled tanks are expected to result in 18 percent annual O&S cost savings while improving operational readiness. Life cycle O&S savings could exceed \$2B with full implementation.

4.4.3 Design for Reduced O&S [Pilot Program: LPD-17]

INITIATIVE: The LPD-17, a new class of amphibious ship, is reducing TOC upfront in the design process by designing and producing a ship which requires fewer people, less maintenance, and still provides for enhanced ship operations. The program intends to accomplish these cost avoidances through acquisition focus on life cycle, Fleet involvement, and specific investments. The program office and the coalition of shipbuilders responsible for design and production have identified the principal O&S cost drivers and the following “Top 10 O&S Cost Avoidance Items”:

- Manning Reduction
- Advanced Enclosed Mast Sensor
- Total Ship Training System
- Coatings
- Corrosion Control
- Ship’s Service Diesel Generator
- Asynchronous Transfer Mode Switch
- Stratica Deck Tiles
- Medium Vs High Pressure Air System
- Synthetic Decking

The opportunity to design improvements allows the LPD-17 to reduce O&S costs, reduce manning levels and sailor workload, and improve quality of life while achieving equal or better performance.

BENEFITS: An anticipated \$18M per ship investment in O&S cost reductions is expected to achieve \$4.3B reduction in projected O&S costs. The program expects to achieve the break-even point on its investments by CY2008 and will have achieved a 3X return by CY2014.

4.4.4 Design for Producibility [Pilot Program: Advanced Amphibious Assault Vehicle]

INITIATIVE: A variety of producibility initiatives have been implemented to reduce production costs, reduce weight, reduce oil and fuel consumption, or improve the producibility of parts. Specific actions include production readiness reviews of critical

vendors; development of an integrated bill of materials; early use of production fixtures; and manufacturing/assembly planning (critical process identification, subcontractor cost reviews, manufacturing design changes).

Examples of specific producibility initiatives include 1) an evaluation of engine producibility and O&S cost drivers to determine design simplifications or enhancements (e.g., turbocharger venting system, exhaust gas manifold, sensor box, fuel injectors, pistons, and piston rings) that will reduce costs and 2) replacement of castings with forgings in propulsor inlet housings to reduce weight and cost and improve strength properties.

BENEFITS: Benefits of the producibility studies will include reduced unit production costs, reduced O&S costs, and weight savings.

4.4.5 Use of Commercial Processes and Technologies to Reduce O&S and Improve R&M [Pilot Programs: Common Ship, CVN-68 Carriers, AEGIS Cruisers, LPD-17]

INITIATIVE: AEGIS Cruisers, CVN-68 Carriers, and Common Ship are all adopting commercial technologies, products, and processes to reduce ownership costs and improve crew quality of life. Examples include use of commercial preservation teams and installing commercial kitchen equipment, seals, and fuel fill indicators.

- Commercial food preparation equipment will reduce costs and improve food quality (AEGIS cruisers and LPD-17)
- Contractor corrosion control specialists will not only replace sailor workload in routine chipping and painting tasks, but the use of trained professionals will also improve corrosion control, reduce corrosion, and reduce the frequency of repainting (Common Ship)
- COTS mechanical seals will double service life, reduce fluid leakage (Common Ship)
- Other COTS installations, such as fuel fill control system, automated oil analysis, and magnetic couplings will reduce maintenance requirements, extend equipment life, reduce O&S costs, and reduce fuel and oil waste (Common Ship)
- Adoption of commercial tank level indicators, multi-jack fastener, remote monitoring TV cameras, smart card, surge suppressors, Golar 500 incinerator, stratica tile to replace conventional decking, wireless Local Area Network (LAN), and other technologies will improve parts durability, reduce the frequency and complexity of maintenance actions, and reduce O&S costs. (Common Ship, Aegis, LPD-17)

BENEFITS: Benefits include reduced maintenance workload for sailors, far less frequent repairs and replacements, and reduced O&S costs. All of these initiatives also allow the Navy to capitalize on commercial R&D.

4.4.6 Commercial off the Shelf (COTS) Electronics [Pilot Program: C/KC-135 and others]

INITIATIVE: The C/KC-135 has adopted a number of initiatives to replace obsolete electronics with COTS electronics, backed by a no-fault manufacturer's warranty. PACER CRAG is a cockpit upgrade, which replaces the compass and radar and adds global positioning system (GPS) capabilities. This upgrade eliminates the navigator for most missions and replaces 40 depot level reparable (DLRs) with 19 COTS DLRs. The Reduced Vertical Separation Minimum (RVSM) initiative, which installs precision altitude measuring equipment, replaces nine DLRs with four COTS DLRs, backed by a 10-year no fault warranty. Global Air Traffic Management (GATM) provides satellite-based communication, navigation, surveillance, and air traffic management capabilities.

Other applications of COTS electronics include installation of a COTS solid state recorder and use of commercial spray cool technology (EA-6B) and operational acceptance of COTS processing capability (Cheyenne Mountain Complex).

BENEFITS: Besides reducing O&S costs, these initiatives have a number of operational benefits, including enhanced use of GPS capabilities, compliance with new regulations and flight procedures.

4.4.7 Spray Cool Technology for COTS Electronics [Pilot Program: Advanced Amphibious Assault Vehicle and EA-6B]

INITIATIVE: The AAV program office is attempting to insert non-militarized COTS circuit card assemblies (CCAs) into the AAV. The use of these technologies promises considerable savings in acquisition and life cycle costs, but will also create a variety of operational challenges, including heat build-up in a hermetically sealed enclosure. The AAV program office is developing a spray cool technology to attenuate the thermal extremes that would otherwise occur.

The technology has been tested and validated and is now being implemented on the Systems Development and Demonstration (SDD) model AAVs. Further testing and maturation of the technology will continue.

EA-6B is conducting similar experiments. The EA-6B spray cool system has three elements:

- Heat extraction: a thin dielectric liquid film is sprayed onto electronics with miniature atomizer arrays and evaporates to extract heat, maintaining devices at constant temperature. Heat rejection: The vapor then travels to the heat exchanger for local or remote heat rejection and phase change back to liquid
- Pump/reservoir: The liquid returns to spray chamber using an n+1 redundant pump and filtration system

This creates an "isolated, benign 'commercial grade' environment within a harsh environmental platform."

BENEFITS: The initial tests of the technology in the AAV are being funded through an SBIR arrangement. Significant cost savings, in excess of \$350M, can be achieved by

avoiding the need for expensive and unique CCAs. The technology can potentially be transferred to other applications.

4.4.8 Redesign/Recapitalization [Pilot Program: Heavy Expanded Mobility Tactical Truck]

INITIATIVE: The recapitalization initiative involves both rebuild and upgrade of selected components. Cost drivers leading to the greatest degree of non-mission capable (NMC) status were identified. The rebuild option includes restoring the truck to “zero mile” standards with original technologies by rebuilding major assemblies; reconditioning and replacing selected components; and replacing brake components, hoses, tires, batteries and electrical harnesses. Upgrading the system involves all these steps plus adding a new electronically controlled engine and electronically controlled transmission; crew safety improvements; and increased corrosion protection. Interactive electronic tech manuals (IETMs) being provided as part of this initiative will also improve maintenance and reduce the logistics footprint.

BENEFITS: The impacts of the Extended Service Program are to: improve OR rates; reduce O&S costs; help meet new regulatory standards; and improve safety. The electronically controlled engine and transmission provide for both performance improvements (improved range and reliability) and O&S cost reductions (improved diagnostics, reduced fuel consumption, reduced maintenance).

4.4.9 Use of Value Engineering Change Proposals (VECPs) [Pilot Program: Apache]

INITIATIVE: The Apache’s O&S IPT is made up of representatives of the program office, the user, the Army staff, and the contractor. It examines O&S cost at all levels of maintenance, considering impact both on cost and readiness. Organizations represented on the IPT have proposed a wide range of improvements to this system, among which are five VECPs submitted by the contractor and approved by the contracting officer. These VECPs involved projects to:

- Abrasively clean Main Rotor Blade spars, in order to reduce main rotor blade spar debonding
- Improve material of Primary Nozzle, to reduce cracking which forces removal of the nozzles
- Incorporate improved oil pump in the Nose Gearbox, to reduce removals of the nose gearbox and reduce scrap rate of the oil pump
- Incorporate a protective boot in the Flight Control Actuators to reduce removals of these subsystems
- Apply an environmental barrier sealant to Penta Prism surfaces to prevent coating delamination; the component improvement prevents optical anomalies, obstructions, and loss of transmission

BENEFITS: A total of five VECPs were approved and funded, at a total cost of \$1.24M. In addition to reliability and performance improvements, estimated O&S cost savings

exceed \$5.1M. Under the terms of the VECF agreement, the contractor proposing and implementing the VECF shares in the cost savings achieved by implementing the recommended improvement.

4.4.10 Replacement of Aging Engines and Engine Parts [Pilot Program: C-5]

INITIATIVE: There are two separate initiatives: upgrading or replacing aging components or subsystems in the C-5. The High Pressure Turbine (HPT) project is a \$178M acquisition category (ACAT) III project to replace HPT hardware with new technology and material. It will double turbine life, a key O&S cost driver and readiness degrader on the current engine. The Reliability Enhancements and Re-engining Project (RERP) is a much more expensive and long-term project to replace the existing engines (with a General Electric (GE) CF6-80) and perform other reliability enhancements to the airframe, avionics, landing gear and other subsystems.

BENEFITS: The HPT reduces overall engine removals by 15 percent and reduces HPT overhauls by 50 percent. RERP will reduce TOC by \$8.1B, ensure the aircraft's operational life to 2040, and increase fleet availability. The new engines also are compliant with new noise reduction requirements and permit the aircraft to get to altitude faster.

4.4.11 Data Link Pod Engineering Change Proposal (ECP) [Pilot Program: SLAM-ER]

INITIATIVE: The AN/AWW-13 data link pod is a significant readiness degrader for the SLAM-ER. Before replacement, the failure rate was projected at >200 per year. Only limited pod assets are available on each aircraft carrier or at each forward site, and pod failures require intermediate level repair. The program office developed an engineering change proposal (ECP) to correct this defect. The ECP replaced a BIT radio frequency (RF) signal mixer circuit board in order to remove the card from the forward antenna signal path.

BENEFITS: Benefits include an annual (FY02) cost avoidance of \$11.2M in Naval Inventory Control Point (NAVICP) working capital fund spares procurement and repair costs, reduced fleet maintenance workload, and a reduction in pod failures from >200 per year to <15 per year.

4.4.12 Falcon Flex Avionics Initiatives [Pilot Program: F-16]

INITIATIVE: Principal sustainment issues for a fielded system such as the F-16 include diminishing manufacturing sources (DMS), reliability, and aging issues. The program office and supply chain manager (SCM) have generally found that there are severe limits on funding for upfront engineering and fixes; even if they solve DMS problems and improve reliability, box and system level redesigns are seldom affordable.

The PM and the SCM (OO-ALC) developed the Falcon Flex program to improve reliability and reduce O&S cost. The Falcon Flex approach is to use performance specifications (vs "build to print") approaches and form, fit, function, interface (F3I) procurement on unstable, rapidly changing technologies. The initial focus is on DMS

“long poles,” low reliability items, and large/expensive spares buys; the long-term objective is to create a top-down analysis capable of identifying the best candidates for improvement. Under F3I, configuration control is raised from the chip/card level to the circuit card/SRU/LRU level. The contractor controls the configuration below the interface level and is free to insert technology, resolve DMS problems, and take actions to improve reliability.

Falcon Flex has 17 ongoing initiatives. A principal focus is to identify the cost drivers (at the piece part level). Cost driver visibility allows the SCM to be proactive and facilitates affordable solutions. Once specific cost drivers are identified, costs are compared and ranked, causes are identified, and solutions are formulated and prioritized.

BENEFITS: Falcon Flex initiatives have reduced F-16 O&S costs while also improving reliability. Examples are two early Falcon Flex initiatives, for redesigns of two of the top three O&S cost drivers of the APG-68 radar system programmable single processor (PSP). The PSP memory card replacement project replaced a \$14K component which had a 500 MTBF and a \$3K repair cost with a \$6K throw-away component with a 40,000 hour MTBF. Similarly, the power supply replacement for the same unit replaced a \$70K component with a 500 hour MTBF and \$6K repair cost with a \$8K throw-away unit with 10,000 hour MTBF.

4.5 Supply Chain Response Times/Footprint Reduction

4.5.1 Direct Vendor Delivery (DVD) [Pilot Program: Heavy Expanded Mobility Tactical Truck (HEMTT)]

INITIATIVE: The HEMTT program and DLA established a goal to improve support for the HEMTT and reduce costs by shifting from large DoD wholesale stockage to DVD support. A successor corporate contract was negotiated between DLA and Oshkosh Truck Corp. (OTC) in April 2000. Under the contract, OTC is required to deliver within 5 days via DVD.

BENEFITS: Over 1,800 items have gone under DVD with a reduced recovery rate; the target by year-end is 2,500 items. Since the October 1999 award of the original contract, over \$3M in savings for HEMTT unique and common items have been achieved. DLA and OTC are exploring ways to expand coverage of the corporate contract and the use of DVD should expand throughout the HEMTT and similar programs.

Several efforts are also ongoing to expand and better measure the progress of this initiative. The first of these is the rebaselining of the entire HEMTT National Stock Number (NSN) population to insure inclusion of all DLA HEMTT-coded NSNs. The second is DLA's ongoing negotiation of a Strategic Supplier Alliance with OTC. This is a leading-edge DLA initiative to maximize information sharing and fully leverage customer buying power beyond the current corporate contract structure.

Besides reducing costs, the DVD contract has had other advantages. The reduction in inventories allows for more immediate impact of contractor design changes, the contractor's improved insight into asset visibility influences design changes, and the shared information gives both the contractor and the government increased retail consumption awareness.

4.5.2 Industrial Prime Vendor (IPV) [Pilot Programs: C/KC-135, F-16, and C-5]

INITIATIVE: The DLA's Defense Supply Center, Philadelphia (DLA/DSCP) awarded a long-term IPV contract aimed at providing improved fill rates and reduced cycle times for U.S. Air Force (USAF) Air Logistics Centers' industrial shops to include the C/KC-135 Programmed Depot Maintenance (PDM) line at Oklahoma City Air Logistics Center (OC-ALC), the F-16 maintenance line and landing gear shop at the OO-ALC, and the C-5 PDM Line at Warner Robins Air Logistics Center (WR-ALC). The IPV contractor keeps the bins close to the wrench turners filled for low cost consumable bench stock items such as fasteners, gaskets, seals, o-rings, etc. There are no requisitions and the customer does not pay until the point of use (monthly bill).

BENEFITS: A 98 percent fill rate is required and there are incentives for the IPV contractor to reach a 100 percent fill rate. Total ownership costs have declined as a result of the improved fill rates for these items and the corresponding reduced cycle times and the reduction/elimination of government owned inventory for bench stock items.

4.5.3 Commercial Maintenance Agreement [Pilot Program: Aviation Support Equipment]

INITIATIVE: The Consolidated Automated Support System (CASS) is a DoN standard general purpose, multifunction automated test system used to test and diagnose weapons system electronics. It is scheduled to consolidate 24 automatic test equipment (ATE) types to a single type. This will reduce the number of technical publications required from 624 to 4 disks, reduce the space required by a third, and reduce the personnel required to operate the equipment by half. The Consolidated Service Program (CSP) is a comprehensive commercial depot-repair agreement for CASS station component repair. The original CSP contract was signed with Lockheed Martin Information Systems (LMIS) in April 2000. The contract is an 8-year basic agreement for LMIS to provide services to multiple agencies. The contract is renegotiated annually based on actual demand, and the program office is planning to expand this type of contract to other CASS subsystems. The contract requires 24-hour turn around time for Broad Arrow (downing failure) requisitions, and 30-day turn-around time for non Broad-Arrow requisitions. The contractor holds wholesale inventory. The contract provides an incentive award fee of 1 percent (to a maximum of 5 percent) for each 2 percent improvement in CASS station reliability.

The coverage of the CSP agreement is being expanded to include the CASS electro-optical configuration and the CASS High Power Operational Capability (HPOC) ancillary asset. Discussions with the USAF are also ongoing to investigate the feasibility of implementing a similar agreement for depot repair of the USAF and U.S. Navy (USN) Joint Service Electronic Countermeasures System Tester (JSECST) program in FY02. Initial production of the JSECST was approved in April 2001.

BENEFITS: The anticipated results of the contract include faster turn-around time for requisitions, reduced cost, onsite support availability, and improved reliability. The contract is providing 51 percent savings/cost avoidance over the prior depot contract repair vehicle. Supply Material Availability (SMA) is 95 percent, compared to 79 percent

before the CSP was instituted, and SMA did not fluctuate during the higher operations tempo during Operation Enduring Freedom.

4.5.4 Virtual Prime Vendor (VPV) and Strategic Sourcing [Pilot Program: C-5]

INITIATIVE: The C-5 System Program Director and DLA have been working to improve reliability and mission capability and to reduce PDM cycle time at WR-ALC. DLA awarded a VPV contract to Lockheed Martin Logistics Services (LMLS) in December 2000. It is a 3-year indefinite delivery/indefinite quantity (ID/IQ) contract with two 2-year options and one 3-year option.

The contract is limited to airframe parts (excluding engine and avionics) and covers more than 11,000 separate parts. Under the contract, LMLS provides tailored support to the WR-ALC PDM line and worldwide support for all C-5 operational customers. The contract will be phased in as government parts inventories are consumed. LMLS provides full supply chain management services in the area covered by the contract, including forecasting, establishing subcontractor base, purchasing, supply management, storage, and distribution.

Key features of the VPV contract include:

- An incentive plan for support above established metrics
- Annual program management review conferences
- A requirement for LMLS to move to government electronic commerce/electronic data interchange (EC/EDI) interfaces within 60 days of contract award
- Implementation by LMLS of a DVD/stocked material management strategy with emphasis on migration to DVD
- An LMLS website to allow visibility of orders in process

Under sponsorship of the Air Force Materiel Command (AFMC), the C-5 program is also looking to develop comprehensive supplier relationships through a disciplined process of effectively purchasing materials, products and services to make the supply chain more effective and efficient. The strategic sourcing initiatives cuts across many weapon systems, centers, and agencies, and will consolidate many NSNs, provide longer-term periods of performance, and serve multiple users. C-5 strategic sourcing initiatives include: hydraulic manifolds, flight control surfaces, structural repair, and mechanical repair.

BENEFITS: The VPV contract requires performance metrics that will significantly enhance support to C-5 if LMLS performs to contract requirements for order to ship time, time on backorder, and lead time. If all options are exercised, the contract's potential value is \$1.1B. Benefits of the strategic sourcing initiative include reduced administration (cost and time), economies of scale, and more reliable parts supply.

4.5.5 Reliability Centered Maintenance [Pilot Program: EA-6B and Aviation Support Equipment]

INITIATIVE: Over the last two years the EA-6B Integrated Maintenance Concept (IMC) Team has been conducting a detailed Reliability Centered Maintenance (RCM) analysis on the EA-6B aircraft. RCM is an analytical process used to determine preventive maintenance tasks as well as provide recommendations for other actions necessary to maintain a required level of safety, maximize equipment availability, and minimize operating cost. The team documented the results of their analysis in an IMC Implementation Plan. This plan delineates revised intervals/ maintenance levels (organic versus depot) for preventive maintenance actions.

This plan has been coordinated with fleet representatives and the NAVAIR Industrial Competency. The EA-6B IMC Integrated Product Team (IPT) briefed the NAVAIR IMC Review Board on November 17, 2000, and the implementation was approved in a December 2000 message from the Chief of Naval Operations (OPNAV). Results have been very close to projections.

The Aviation Support Equipment (ASE) Pilot Program has learned that 66 percent of the total cost of all schedule maintenance tasks for Common Ground Support Equipment (CGSE) is driven by 20 percent of the items. In an effort to reduce scheduled maintenance requirements, the program office has performed RCM analyses for selected items. These analyses have been performed by fleet equipment experts (operators and maintainers) under the guidance of a trained facilitator. Analyses for 21 different support equipment (SE) items was performed between FY98 and FY02, with an additional six items scheduled for FY03.

BENEFITS: The implementation of the IMC is expected to decrease EA-6B organizational level maintenance manhours by 121,185 per year (for 106 aircraft) and reduce aircraft out of service time (3,869 days/year for 106 aircraft). ASE reports significant reductions in scheduled maintenance requirements, reduced usage of consumables, and reduced disposal requirements for hazardous materials as a result of the RCM studies.

4.5.6 Condition Based Maintenance [Pilot Program: Advanced Amphibious Assault Vehicle]

INITIATIVE: Condition based maintenance (CBM) is “a set of maintenance processes and capabilities derived, in large part, from real-time assessment of weapon system condition obtained from embedded and/or external tests and measurements using portable equipment.”

The AAAV ORD contains a requirement for overall design goals of ease of maintenance, achieved by “designing test points and self-diagnostics into the vehicle” and the concept “fix as far forward as possible.” The program’s solution is to utilize prognostics to reliably predict the remaining useful life of mechanical components, within an actionable time period and acceptable confidence limits. Implementation of CBM will provide asset management to operational commanders and to the support infrastructure, supports smart maintenance decisions, reduces the number of depot overhauls over the life of the vehicle, and avoids collateral damage. As vehicle integrator, General Dynamics

Amphibious Systems (GDAMS) has begun program planning, data acquisition and fault characterization activities, marine/machine interface definition, and battery health and oil monitoring efforts.¹³

BENEFITS: Implementation of CBM on the AAV is expected to generate a return on investment (ROI) exceeding 35:1.

4.5.7 Integrated Product Data Environment (IPDE) [Pilot Program: LPD-17]

INITIATIVE: The Integrated Product Data Environment (IPDE) is an information system capability which implements, through phases, the integration of a central product model database (Level I), associated data products such as drawings, technical manuals, Government-Furnished Instruction, training materials (Level II), and program execution information such as plans, schedules, and procedures (Level III) in order to satisfy the data requirements of both the Government and Industry Partnership.

BENEFITS: IPDE results in reduced costs for developing, delivering, and maintaining information. The data are entirely developed electronically; they are developed and entered only one time, and can be re-used throughout the life cycle for all 12 hulls. In addition, the IPDE will increase the accuracy and availability of data to end-users. Members of the government-industry team will be able to access the data on-line, and there will be a single location for current ship configuration data. In addition, the extra costs incurred due to data re-hosting are eliminated by using IPDE. Over ½ of design and production data is re-used during O&S, both by ships force and by shore support activities. With the ability to reuse data, the program can avoid the need to replicate this information to populate external information systems for use during the ship's life cycle.

4.5.8 Interactive Electronic Technical Manuals (IETMs) [Pilot Program: HEMTT]

INITIATIVE: The original increment of R-TOC funding under PBD-721 provided funds for HEMTT to convert existing paper-based manuals to IETM format. Funding was received in October 00. This IETM was developed as an intrusive diagnostic tool for the maintainer, as opposed to a direct translation from paper manuals. The effort has achieved significant dividends in improved usability and supportability.

Initial actions included building a basic HEMTT IETM and developing subcontractor strategic partnerships with the OEM and the contractors selected to develop the IETMs. Subsequent actions included incorporating data from recent models, incorporating embedded training modules, devising a revised Repair Parts and Special Tools List

¹³ The AAV's CBM activities have served as one of the models for the OSD/Logistics and Materiel Readiness (L&MR) "Condition Based Maintenance Plus" (CBM+) initiative. CBM+ is intended to "improve the integration of maintenance, configuration management, and other logistics processes" through a wide variety of functions and features, including: prognostics/diagnostics, trend analysis, serial number tracking and asset visibility, integrated information systems, IETMs, and planned maintenance availability (PMA). CBM+ is included as one of six key components of the L&MR "Future Logistics Enterprise" activity.

(RPSTL) based on reconciliation of Logistics Support Analysis Report (LSAR) and Provisioning Master Record (PMR) databases, and incorporating latest engineering design changes.

Specific functional improvements include: (a) improved navigation within the IETM by consolidating task databases; (b) the addition of numerous additional troubleshooting tasks, which were systematically mapped to ensure coverage and logic flow; (c) consolidation of TM information from newer HEMTT variants to simplify the maintainer burden by leveraging system commonality; and (d) the addition of magnifying windows to enhance schematic reliability. The HEMTT IETM has been fully validated by soldier maintenance subject matter experts from the Ordnance Center and School, authenticated as an Army manual, and used to support the Type Classification/Materiel Release for the objective ESP configuration. It is now being fielded with that configuration with full maintainer training under Unit Set Fielding. The major ongoing activity with IETMs is the addition of Point to Point (P2P) schematic animation to provide additional visual tools as a general mechanics refresher and orientation. These advances also feed the companion IETM for similar OTC-produced military tactical vehicles as the program moves to embedded systems which encompass system health monitoring, diagnostics, data collection, and ultimately prognostics capabilities.

BENEFITS: Benefits of the IETM include:

Cost savings and cost avoidance opportunities

- Diagnostic and prognostic capabilities
- Reduced cycle time for troubleshooting
- Reduced No Evidence of Failure (NEOFs)
- Maximum leverage from existing palletized load system (PLS) IETM
- Continued focus on soldier safety

4.5.9 Diagnostic Test Equipment [Pilot Program: Airborne Warning and Control System (AWACS)]

INITIATIVE: Aircraft availability is a particularly serious issue for Low Density/High Demand (LDHD) systems like AWACS. The Pinpoint Tester is a diagnostic test unit that recognizes and alerts the user to faults in circuit cards. It accommodates both analog and digital testing. Besides not performing as efficiently, the legacy tester is no longer supportable at the depot.

BENEFITS: The new system will provide superior diagnostic performance, substantially reduce life cycle cost, and improve aircraft availability. \$8M in cost avoidance is projected within the Five Year Defense Plan (FYDP) alone, and the overall ROI is projected at 11.4:1. Funding for this project was approved in the most recent R-TOC PBD.

4.5.10 Commercial Buying and Management Initiatives [Pilot Program: C-5]

INITIATIVE: The Avionics Modernization Program (AMP) is an \$850M, ACAT II program to modernize and upgrade major parts of the C-5 avionics. The AMP will meet new GATM requirements, and replace unsupportable flight control system and engine instrumentation. The project's vision is to provide a total GATM solution which reduces TOC by designing in the ability to easily adapt commercial standards and technology. This involves a considerable cultural change for the program. When the original concept, based on "reuse" and "upgrade" proved to be too complex, the contractor proposed using military product lines based on commercial product lines. The commercial systems approach provides a complete development-to-application environment and building block design.

Management of the C-5's two major modernization initiatives AMP and RERP (see Section 4.4.10) has been reorganized into a single modernization team, with Lockheed Martin in the lead. Joint configuration control boards are also being developed.

BENEFITS: Benefits will include reduced sustainment and upgrade costs and reduced cycle time. By relying on commercial solutions to evolving international standards, the new capabilities can transition relatively easily to military product lines with minimized missionization for each weapon system. Testing and training is leveraged across systems.

4.6 Competitive Product Support

4.6.1 Total Systems Sustainment Program (TSSP) [Pilot Program: F-117]

INITIATIVE: The F-117 TSSP contract was designed to reduce sustainment and support cost for the F-117 fleet with no impact to the warfighter's combat capabilities. The focus of the contract was to eliminate duplicative support infrastructures and move the non-core weapon system integrator task from the government to private industry.

The key elements of this strategy are a performance-based sustainment contract between the government and the contractor, Lockheed Martin Aeronautics (LM-Aero). Under this approach the contractor assumes responsibilities in general administration, warehousing, spares procurement, repair decisions, and sustainment engineering tasks while the government retained its core responsibilities. Performance-based metrics were developed between the warfighter, the systems program office (SPO), and the contractor where all organizations could monitor contract performance with minimal manpower. This streamlined evaluation process allowed the government to relinquish its traditional role of oversight and institutionalized a role of insight.

The contract provides incentives to reduce TOC. The contract type is a cost plus incentive fee (CPIF), with an award fee feature, which allows the contractor to receive an incentive fee if the company meets the performance metrics and is on or below target cost. The contractor would also share with the government 50/50 on any cost under-run or over-run. Measurable results fit into three different categories: personnel savings, savings due to stabilized funding, and contract under-runs.

BENEFITS: To date the F-117 SPO has reduced its personnel count 76 percent, representing an eight-year savings of \$82M. Second, through concurrence by ACC, the F-117 SPO adopted a stabilized funding arrangement that guarantees the contractor negotiated funds for each of the years of the contract in exchange for an additional \$80M cost savings to the warfighter up front. The cost/savings-sharing aspect of the TSSP contract has motivated the contractor to implement several process improvements that have yielded cost under-runs in each of the first two years of this contract. These under-runs have given ACC and program management the flexibility to address unforeseen internal funding deficiencies.

ACC's portion of the underrun was \$3.9M in FY99, \$6.05M in FY00, \$4.6M in FY01, and \$6.0M FY02. These savings are reinvested in other R-TOC initiatives (such as the engine sustainment program) by the SPO subject to direction from ACC.

4.6.2 Contractor Logistics Support [Pilot Program: Integrated Target Acquisition System (ITAS)]

INITIATIVE: The principal element of the ITAS R-TOC approach is Contractor Logistics Support (CLS). The objective of the CLS contract is to improve system availability while reducing support costs. It is a fixed price contract with performance adjustment based on operational readiness (OR) rates of supported units. The initial contract covered the transition period from FY00-01, and a five-year follow-on contract was signed in December 01. A contingency option to the contract has also been exercised. The contractor is incentivized to reduce reliability and maintainability costs and provide continuous technology refreshment.

Under the contract, the contractor provides supply of parts, serves as item manager for ITAS-peculiar parts, depot repairs, and configuration management (CM) below the performance specification (line replacement unit) level. (The government provides CM above the line replaceable unit (LRU) level.) The \$16M estimated cost for a technical data package was considered prohibitive, so the government has not purchased data. The primary incentive in the contract is for OR rate; a minimum requirement of 90 percent is established, with incentives for exceeding this rate and cost penalties for falling short.

The Program Manager's decision to rely on CLS was made following a Level of Repair Analysis (LORA) performed using the Computerized Optimization Model for Predicting and Analyzing Support Scenarios (COMPASS) model. Cost analyses of various options supported using CLS. There was no requirement for an A-76 study because there was no existing legacy support structure (organic depot, personnel, spares inventory). No organic depot is assigned to the ITAS, though the soldier still provides support at the unit level.

BENEFITS: Over the life of the system, the CLS concept is estimated to incur \$300M in cost avoidances. Design improvements such as built-in test/built-in test equipment (BIT/BITE) and modular design have improved accessibility and reduced the need for organizational test equipment and special tools. The CLS contract also incentivizes the contractor toward 100 percent OR rates; the contractor has been able to maintain a 100 percent OR rate even during contingency operations.

4.6.3 Team Armor Partnership [Pilot Program: Abrams Tank System]

INITIATIVE: Team Armor Partnership (TAP) is a government industry partnership at Ft. Hood to provide improved logistics support through direct delivery of unique LRUs and subsystem repairable units (SRUs) for the M1A2 and M1A2 System Enhancement Program (SEP). It is a partnership between PM Abrams, TACOM, and GDLS. Under the agreement, GDLS is the depot level repair facility for M1A2 unique support, and M1A2 unique spares and repairs are provided by direct ship, EC/EDI methods. DLA awarded a long term contract with DVD provisions, which expanded coverage to include DLA-managed parts as well, in April 2001. The concept has been applied at the National Training Center and Ft. Polk, and has expanded to include the Wolverine (a mobile bridge system mounted on an M1A2 chassis) and Bradley vehicles. Future plans call for expanding the concept to other Army facilities and potentially to include foreign military sales (FMS) customers.

BENEFITS: Besides improving reliability and maintainability, this Partnership also reduces cycle time, increases readiness, reduces surcharges, and provides a simpler, retail-style supply system. For the DLA contract, benefits include reduction of lead time averages from 320 to 15 days and reduced government inventory.

4.6.4 Life Cycle Support Study [Pilot Program: Comanche]

INITIATIVE: Like many other developmental systems, the Comanche program office has launched a life cycle support study.

The study will:

- Determine and document Source of Repair and Core Logistics for all repairable items
- Include economical and analytical tradeoffs using “Best Value” of support between the organizations available and capable of performing the support
- Consider several other areas of support, including training support, technical publications, and supply support

Phase One of the Life Cycle Support cost benefits analysis (Study) began in January 2001 and was completed in February 2002. Phase two of the study will cover Post Deployment Software Support (PDSS) and started in February 2002. Study teams have been formed to look at depot repair, supply management, publications, and training. The Army-approved COMPASS model is being used in these analyses.

Partnerships between Government and Industry will be formed to optimize each area of support requirements and to comply with OSD/Army guidance as well as US Laws. For example, organic (Government) depots and the original aircraft manufacturer are included in trades to determine which organization would provide the best overall value for depot level repair and overhaul (some combination of both will likely result). Organic depots will accomplish repair and overhaul on items where they provide best value in addition to all items identified as “Core.” Similarly, the OEM will accomplish maintenance on items where they prove to be best value. Other areas traded include

supply support, distribution, technical publications, training support, and others. “User Level” maintenance has not be considered for analysis under the study as it will be accomplished by the soldier. Operator and Maintainer Training will continue to be performed by the Training and Doctrine Command and also will not be analyzed.

BENEFITS: The results of the study, when completely analyzed and approved, will allow the Comanche Project Manager to tailor the weapon system life-cycle support program into a progressive, benchmark support system. Comanche aircraft support will be modeled after the best available support systems and will implement continuous improvements. A combination of Government and industry support will be utilized to accomplish support goals. The support system requires that reliability and performance improvements be accomplished through the blocking strategy and by technology insertion via Modernization Through Spares initiatives. Support improvements will be accomplished by process improvements following metric indicators that require increased Return On Investments and reduction in O&S costs.

4.6.5 Soldier Focused Logistics [Pilot Program: CH-47]

INITIATIVE: Cargo Helicopters is in the planning stage of a PBL initiative, termed Soldier Focused Logistics (SFL). When fully operational, SFL will:

- Improve quality and availability of spare repair parts to soldiers on the flightline
- Reduce dependency of field units on the historically under-funded Army Working Capital Fund (AWCF)
- Guarantee delivery and performance of spare components and repair parts
- Provide “forward looking” analysis tools and information systems for fleet management at all levels

BENEFITS: SFL will relieve operational units of the burden to manage the financial aspects and minimize the complex record keeping required for Army Aviation Maintenance Management. This will be accomplished via the development and integration of revised maintenance processes, existing asset and information management technologies, and a centralized fleet management program. In short, SFL will allow unit commanders and their maintainers to concentrate on readiness and mission accomplishment without the restraints and concerns associated with the present system.

4.6.6 PBL Activities [Pilot Program: H-60]

INITIATIVE: The H-60 team is an active component of the team effort on four PBL initiatives:

AN/AAS-44(V) Forward-Looking InfraRed (FLIR): An initiative with Raytheon Systems (McKinney, Texas) (in concert with Naval Aviation Depot [NADEP] Jacksonville through a commercial services agreement) covers the three major components of the system (hand control unit, turret unit and electronic unit). Award of the contract is anticipated shortly.

SH-60B Avionics: Signed in May 2002, this 42 national item identification number (NIIN) contract with Lockheed Martin Systems Integration has completed its five-month asset lay-in period. The first formal Performance Review Board was held in January 2003.

Dynamic Components: Also known as PBL-14, this initiative with Sikorsky contains 14 items. Significant improvements realized recently in Sikorsky's capacity/capability at its overhaul and repair facility have greatly improved the government's confidence.

Tip to Tail: A 1,300+ NIIN initiative with the Maritime Helicopter Support Company (MHSCo) (joint venture teaming between Sikorsky and Lockheed Martin) is also under development. It includes the items covered by the Avionics and Dynamic Component contracts as well as nearly every other Navy-peculiar H-60 item. Confidence is high on both sides (government and contractor) that this complex program can come to fruition. Recent success with the Dynamic Component contract and a refreshed focus within the government has led to recently revised contract award date of mid-late May or early June 2003. Risk identification and feasibility analysis by the program office continues which will require several adjustments to the contractor's proposal and the government's Business Case Analysis (BCA).

BENEFITS: Benefits include reduced wait time, reduced inventory, requirements, and reduce O&S costs.

4.6.7 HIMARS Product Support Strategy [Pilot Program: Precision Fires Rocket and Missile Systems (PFRMS)]

INITIATIVE: As presently constituted, the Precision Fires Pilot Program includes legacy MLRS systems as well as the developmental HIMARS (a wheeled, as opposed to tracked, MLRS launcher). HIMARS, the original focus of this Pilot Program, has a Long Term Logistics Support IPT, which has explored various logistics support issues and developed a proposed HIMARS concept.

The proposed HIMARS product support concept represents a significant evolution from the original M270 MLRS launch vehicle (which provided for essentially all support tasks (initial provisioning, inventory management, war reserve stock, repair and overhaul, depot maintenance, etc.) to be performed or managed by organic sources and the current M270A1 (which retains most functions with the government but provides responsibility for inventory management, repair, status monitoring, database management, and a few other tasks to contractors). The proposed HIMARS management plan assigns most tasks to contractors and retains government responsibility for program management, initial provisioning, sustainment engineering, supply support oversight, and other oversight functions.

BENEFITS: The HIMARS product support concept was designed to be 100 percent compliant with existing guidelines, such as DoD acquisition regulations, limitations on contractors on the battlefield, and rules about core depot maintenance requirements. The new system is designed to reduce repairable costs by nearly half compared to the systems it is replacing. No change will be visible to the field units; they will interact exactly the same way with the supply and maintenance systems.

4.6.8 Life Cycle Management Program [Pilot Program: Guardrail/Common Sensor (GR/CS)]

INITIATIVE: The Life Cycle Management Program is an outgrowth of the discussions between the Guardrail/Common Sensor (GR/CS) program office and other stakeholders. Initial attempts by the program office to discuss development of a Guardrail-specific working capital fund for priority sustainment efforts, TOC reduction initiatives, and enhancements were not successful, but the various stakeholders were willing to discuss development of a methodology to prioritize work efforts among stakeholders. A GR/CS Life-Cycle Management Program IPT has been formed, which represents all the GR/CS stakeholders, including PM Aerial Common Sensor (ACS), CECOM, Forces Command (FORSCOM), Intelligence and Security Command (INSCOM), US Army, Europe (USAREUR), and the Directorate of Combat Developments (DCD). The objectives of the effort are to identify performance measures for primary mission equipment and ground station equipment, establish priorities for sustainment and modernization of all GR/CS systems, reduce duplicative efforts, and maintain visibility into the financial status of priority efforts. In other efforts under the PBL initiative, MOAs have been developed between the major using commands (FORSCOM, INSCOM, USAREUR) and the program office, and efforts are being made to develop performance agreements with all support providers.

BENEFITS: Anticipated benefits include more focused use of scarce O&S funds and more balanced consideration by the program office and users of near-term performance objectives and longer-term system improvement plans.

4.6.9 Combined Life Time Support (CLTS) [Pilot Program: F-16]

INITIATIVE: Combined Life Time Support (CLTS) is an F-16 program initiative designed to provide an alternative approach to system sustainment. Prior to the implementation of CLTS, program sustainment costs were increasing because of the need for complex and frequent changes, the expense of requiring the OEM to maintain design and maintenance data, and the difficulty of maintaining and changing support equipment. The increasing frequency of DMS problems was imposing a large workload on Air Force personnel and the system's integrated software architecture meant that small changes could cause very large expenses.

Under CLTS, the contractor is responsible for proactive DMS management; a long-term FFP contract provides the contractor with the incentive and the opportunity to choose economical DMS fixes and incorporate R&M improvements. The contractor determines the timing and approach to DMS prevention and resolution and is required to resolve DMS before it impacts sustainment. The contractor is given CM control to support DMS changes.

Government and the contractor share material management responsibilities. The depot provides a single POC for users/customers, priority shipping instructions to the contractor; follow on spares approval, and management actions for parts shortages. The contractor is responsible for equipment repair, DMS management and total system performance, and maintenance of a systems maintenance database.

The contractor is required to accomplish repairs in accordance with performance based specifications and must guarantee 30-day turn-around time on repairs. Repairs and DMS fixes must also provide equal or better performance. The contractor is incentivized to improve reliability.

BENEFITS: The CLTS initiative has significant benefits for both government and the contractor. From the government's viewpoint, benefits include keeping the "core" workload organic, achieving systems sustainment "at a known cost," guaranteed repairs, DMS resolution, and opportunity to partner with the contractor. Benefits to the contractor include an enhanced business opportunity, support of a company product line, an opportunity to promote design changes and increased reliability, and an opportunity to partner with the government.

5. Summary and Lessons Learned

Each of the 30 R-TOC Pilot programs has made important contributions to DoD's efforts to improve readiness and reduce total ownership costs. Their activities to identify R&M improvements; reduce logistics cycle time; and promote competitive product support can lead to significant ownership cost reductions and readiness improvements.

However, although these Pilot Programs are very important, their individual activities may not represent the principal benefits of the R-TOC program. Even more important is the potential leverage that the hundreds of other DoD programs can achieve by learning from the experiences of these Pilot Programs. The Pilot Programs' advocacy for R-TOC within their own organizations builds support for R-TOC throughout DoD. Additionally, as the Pilot Programs have gained experience with the identification, implementation, and evaluation of R-TOC investments, their experiences with what works provide important knowledge to help other DoD programs. The Best Practices documented in this guide provide specific examples of R-TOC initiatives that have worked in a specific program and may work in other similar programs.

The documentation of Lessons Learned has been an important objective for R-TOC Pilots since the beginning of the program. Whereas the Best Practices described in Chapter 4 describe specific initiatives taken by specific Pilot Programs, Lessons Learned represent comments of Pilot Programs about the R-TOC initiative itself: management practices, barriers, enablers, etc.

These Lessons Learned are developed through the quarterly R-TOC Forum, where the Pilots meet to report on their progress and to share lessons learned. In addition, Pilots are asked to document Lessons Learned in their quarterly progress reports. Many of these Lessons Learned represent consensus inputs from a number of Pilot Programs.

5.1 R-TOC Funding and Management

5.1.1 Funding

Budgeting for R-TOC. Although R-TOC has been directed at the OSD/Service staff level, the Service requirements and budget processes have the ultimate authority over which R-TOC initiatives will be funded. R-TOC reporting schedules and management processes must be consistent with these Service processes. Without such coordination, many R-TOC initiatives will not be fully implemented.

R-TOC Funding. Funding sources such as PBD-721 and the CREIC-supported funding provide a big boost to the program and will contribute significantly to program R-TOC goals.

Color of Money. The "color" of money is a significant issue in budgeting for R-TOC initiatives. PMs need to access R&D, procurement, and O&M funds for R-TOC initiatives. Many Pilot programs receive funding from a wide variety of funding sources and categories: R&D, procurement, or O&M; annual appropriations or working capital

funds. Each source of funding has its own approval procedures, timing, and restrictions on what it can be used for. These procedures can have a significant influence on the ability of program managers to carry out R-TOC investments.

Budget Stability. Budget stability was identified as a key contributor to meeting R-TOC goals, and the absence of funding stability was identified by program managers as the number one issue preventing accomplishment of R-TOC goals. Funding changes have a double impact: (1) the strongest plan can die in execution because the resources allocated are not available and (2) the management attention required to reclama or develop alternatives detract from improving the well-planned baseline.

Variables such as programmatic delays, funding re-allocations, changes to deployment, depot maintenance, or modification/upgrade schedules, etc., all have major impacts upon reaching projected FY05 savings.

Savings Retention. The removal of anticipated savings from outyear program budgets can make it more difficult to achieve R-TOC goals. Budget cuts can make it impossible to make the investments necessary to achieve the savings, so that the removal of the anticipated savings cannot be corrected.

5.1.2 Management

Program Management. Although labor intensive for the program office, being an R-TOC Pilot program has provided the visibility needed for some programs to obtain additional funding for O&S cost-reduction initiatives.

However, some Pilots are concerned that the benefits of R-TOC participation might not equal the costs. Some programs have noted a lack of support for R-TOC within the budget process or among competing functional organizations and programs. “Changing the way business is done” is difficult, and program offices may not be staffed adequately to handle R-TOC analytical and programmatic requirements. Some Pilots have suggested that Pilot programs should receive higher priority for Service investments and have advocated reinvestment authority for all or a portion of R-TOC savings.

Benefits of R-TOC Participation. Several Pilot Programs noted that benefits of participation in R-TOC can include higher visibility, higher priority for funding requests, and access to good ideas from other Pilot Programs. One Pilot observed that PBD-721 and CREIC-supported funding was a big boost to the program and will contribute significantly to program R-TOC goals. The program also observed that the Quarterly forum provides opportunity to exchange ideas across services and programs. The Quarterly report provides a simple mechanism to report progress and is least intrusive to the team. Another program office has had representatives attend Cost Reduction IPT (CRIPT) meetings held by other R-TOC programs and stated that cross-community participation helps all programs involved.

Coordination of Requirements. Several Pilot Programs have found that having authority to manage both “acquisition” and “legacy” requirements has big advantages for both PM and the command. It can result in improved synchronization and avoidance of potential duplicative software functionality.

R-TOC Metrics. New and improved R-TOC metrics are needed. Most Pilot programs are finding that traditional information systems do not provide the right information to track R-TOC baselines, investments, and cost savings. The R-TOC Working Group and the Pilot programs are working to develop better visibility of O&S costs and improved metrics to help develop O&S cost baselines, identify sources of funding for readiness improvement and sustainability investments, and measure the impact of R-TOC improvements. Development of accurate R-TOC metrics is difficult, especially when the R-TOC improvements are deployed across a diverse range of systems and platforms. Lack of visibility into O&S costs at the system level can make it particularly difficult to identify the benefits of potential R-TOC activities. Some Pilots advocated establishing a database of relevant government O&S cost returns and studies.

Consistency in tracking R-TOC metrics can also be difficult. Use of conventional cost templates can generate erroneous aggregates for individual projects. The proponents for R-TOC initiatives must validate and verify the assumptions and methodologies used for cost/benefit analyses. A system of metrics must be developed to assess the performance of installed R-TOC initiatives. It is difficult to consistently get data and feedback from the ships for installed R-TOC initiatives.

Projected metrics developed prior to TOC installation often vary when developed at independent sources and may not agree with actual data gathered after the initiative has been installed. It will be difficult to develop metrics for cost avoidance and determine actual savings. True R-TOC savings may not be known until the initiative has been installed for many years and return costs can be measured.

Team Participation. Active participation by all members of a large and complex team is required for R-TOC success. This participation includes many different functional offices within the PM organization, the buying command, the user, and the equipment manufacturer. The sponsor also must establish a TOC-conscious culture within government and industry.

Although the program/project manager is typically responsible for identifying potential R-TOC activities, it is increasingly evident that many other organizations must also be involved in R-TOC. In fact, in many cases, the PM may not be responsible for the funding necessary to implement an R-TOC initiative and may need to coordinate basic funding decisions with other organizations. Participating organizations should include: the buying command/PEO structure, the user, organizations with logistics support responsibilities, organizations with budget development and approval authority, and the prime contractor/major subcontractors. User involvement is particularly important in building support for ownership cost reduction initiatives, especially in the case of fielded systems where the user controls many of the funding sources.

User support for R-TOC initiatives is critical. R-TOC efforts will be hindered until the user gets sufficient direction to participate in these initiatives. This requires working with the user to help them understand the benefits of the initiatives, incorporating their feedback back into the system, and working with them to ensure that implementation funding is included in the budget.

One Pilot observed that R-TOC cannot be implemented by acquisition commands alone. Warfighters and maintainers have a large role in how ownership costs associated with the

operation and maintenance of the system can be minimized. Increased management attention with maintenance management at the local levels can lead to efficiencies that will result in overall TOC reduction in fleet managed O&S funding accounts.

The total weapon system supplier base (primes and subs) also must be engaged in R-TOC and actively pursuing cost reduction initiatives.

5.2 R&M Improvements

Designing in TOC Reductions. The majority of weapon systems future life cycle costs (LCC) are tied to design. Consequently, to maximize LCC savings, reliability, maintainability, and availability must be built into the system from its inception. As upgrades and enhancements are made, the implication of life cycle cost is a key parameter in evaluating these modifications.

Sustaining Engineering. Once the system is out of production, PMs can have a difficult time identifying funds for sustaining engineering projects that would improve RM&S. While systems still are in production, funds for these activities are subject to the PM's control. Once the system is out of production, O&S funds typically are controlled by the users, who are likely to have different priorities for sustaining engineering projects.

Legacy Systems. Major modifications may provide the best opportunity to implement O&S cost reductions and readiness improvements in legacy systems.

One-of-a-Kind. One-of-a-kind or few-of-a-kind systems pose unique challenges for R-TOC because the improvements are spread across only a small number of systems and many have unique configurations.

O&S Cost Drivers. Focusing on O&S cost drivers and principal readiness inhibitors can yield the best results for R-TOC investments. Often, a single subsystem, component, or practice is found to be a major driver of O&S costs or readiness inhibitor. Several Pilot Programs have achieved significant cost savings and readiness improvements by identifying these critical issues early-on in the R-TOC process.

O&S Cost Increases. It is important to recognize that aging systems will continually face "unknowns" that will drive up O&S costs. Additionally, installation of new subsystems can increase capability but also increase manning and maintenance requirements (and TOC).

Another constraint to reducing the net TOC of a ship is that some new shipboard systems will increase TOC, but congressional mandates or other legislation require that they be installed. For example, because of congressional mandates issued to reduce pollution of the seas, pollution control systems have been installed (Plastic Waste Processors, Oily Waste Separators, etc.). While these systems are necessary and important, they necessitate additional maintenance and manpower, thereby increasing TOC.

Transition of Technologies. In the case of relatively proven technologies, hurdling from R&D into acquisition/implementation is a major obstacle. Simply doing a demo of technology is not enough to clear that barrier. We must actively work to overcome all obstacles up front (i.e., testing, documentation, drawings, procedural/policy/guidance changes) and couple the technology with the actual Fleet need in order to achieve a sound acquisition package and approval for installation. Formation of the Service-Industry IPT

for the sole purpose of identifying and conquering those obstacles to acquisition through teaming and risk mitigation has assisted the process.

5.3 Supply Chain Response Time/Footprint Reduction

Pilot projects can achieve significant cost savings through supply chain management process and efficiency improvements. R-TOC Pilot Programs have implemented a wide range of projects to improve the management or efficiency of the system's supply chain. Direct vendor delivery (DVD) contracts, corporate contracts, and other supply chain initiatives can reduce logistics cycle time at the same time it reduces O&S costs.

Depot Maintenance. Significant O&S cost reductions can be achieved by extending depot maintenance cycles. By grouping depot maintenance activities differently and using actual experience with systems in the field, it may be possible to extend these cycles without impacting system performance or reliability.

Supply Chain. Supply chain management process and efficiency improvements, including increased use of corporate contracts, direct vendor delivery (DVD) arrangements, and reductions in DLA cost recovery rates can result in significant cost reductions at the same time parts availability improves.

Reliability Centered Maintenance. One Pilot Program expects to save 120,000 maintenance manhours per year and reduce system downtime by switching to this concept.

5.4 Competitive Product Support

Planning for Support. Significant cost savings can be achieved by competing work traditionally performed in government depots. Because it takes time to build and coordinate an innovative product support strategy, it is important to begin this planning early in the system's life cycle.

Life Cycle Support studies should include representation from all stakeholders, including the program office, depots, and users.

Government Responsibility. Even in cases where a contractor is given Total Systems Performance Responsibility (TSPR), the program director is still ultimately the one responsible for customer satisfaction. The program should consider "off-ramps" to maintain competitive pressure on the contractor and protect the government in case the arrangement doesn't work out (e.g., provisions for recompetition, return to organic support, etc.).

Government-industry Partnerships. Life cycle support partnerships between the depots and private industry can provide a successful way to reduce TOC while taking advantage of the best available capabilities.

Incentives. Incentive is the key to energizing the contractor. Allowing the contractor to program savings internally to other cost saving initiatives offers appropriate incentive for effective implementation of R-TOC. If the savings are not recouped by the initiative owner and R-TOC is simply mandated, there is substantially less imagination and creativity generated.

Award fee and award term contracts, which increase the contractor's profits or the length of the contract, can provide strong incentives to reduce TOC.

Policies. Some relief from legislative or policy requirements (e.g., A-76 procedures, 50:50 workshare requirements, core logistics capabilities, etc.) may be required before it is possible to implement competitive product support on a wide basis.

Timing. The ability to implement competitive product support is limited for legacy systems. Major modifications and other major events provide an important opportunity to implement these arrangements.

Commercial Improvements. Incorporating improvements that occur naturally in the marketplace (commercial technologies, products, and processes) is one way to reduce O&S costs.

Appendix A. Acronyms

AAA	Advanced Amphibious Assault
AAAV	Advanced Amphibious Assault Vehicle
ACAT	Acquisition Category
ACC	Air Combat Command
ACS	Aerial Common Sensor
ACW	Air Control Wing
ADOCS	Advanced Deep Operations Coordination System
AFATDS	Advanced Field Artillery Tactical Data System
AFMC	Air Force Materiel Command
AFTOC	Air Force Total Ownership Cost
AIM	Abrams Integrated Management
AIT	Automatic Information Technology
AMAC	Advanced Maintenance Aid Concept
AMP	Avionics Modernization Program
ANAD	Anniston Army Depot
APB	Acquisition Program Baseline
ASE	Aviation Support Equipment
ATE	Automatic Test Equipment
AT&L	Acquisition, Technology and Logistics
AWACS	Airborne Warning and Control Systems
AWCF	Army Working Capital Fund
BCA	Business Case Analysis
BIC	Business Initiatives Council
BIT	Built-in Test
BITE	Built-in Test Equipment
CAIV	Cost as an Independent Variable
CASS	Consolidated Automated Support System
CBM	Condition Based Maintenance

CBM+	Condition Based Maintenance Plus
CCA	Circuit Card Assembly
C3S	Command, Control, Communications, and Surveillance
CECOM	Communications and Electronics Command
CGSE	Common Ground Support Equipment
CH	Cargo Helicopter
CLS	Contractor Logistics Support
CLTS	Combined Life Time Support
CM	Configuration Management
COMPASS	Computerized Optimization Model for Predicting and Analyzing Support Scenarios
CONOPS	Concept of Operations
COSSI	Commercial Operations and Support Savings Initiative
COTS	Commercial Off the Shelf
CPIF	Cost Plus Incentive Fee
CREIC	Cost Reduction and Effectiveness Improvement Council
CRI	Cost Reduction Initiative
CRIPT	Cost Reduction Integrated Product Team
CSMI	Cost Savings Modernization Initiative
CSP	Consolidated Service Program
CVN	Nuclear Powered Aircraft Carrier
CVNX	Nuclear Powered Aircraft Carrier – Experimental
DCD	Directorate of Combat Developments
DLA	Defense Logistics Agency
DLR	Depot Level Repairable
DMS	Diminishing Manufacturing Sources
DMSMS	Diminishing Manufacturing Sources and Material Shortages
DoD	Department of Defense
DoN	Department of Navy
DRPM	Direct Reporting Program Manager
DSCP	Defense Supply Center, Philadelphia
DT	Development Testing
DTOSC	Design to O&S Cost

DUSD/L&MR	Deputy Under Secretary of Defense/Logistics and Materiel Readiness
DVD	Direct Vendor Delivery
EA	Electronic Warfare Attack Aircraft
EC	Electronic Commerce
ECP	Engineering Change Proposal
EDI	Electronic Data Interchange
EOQ	Economic Order Quantity
FATDS	Field Artillery Direct Support
FED	Forward Entry Device
F3I	Form, Fit, Function, and Interface
FFP	Firm Fixed Price
FLIR	Forward Looking Infrared
FMS	Foreign Military Sales
FORSCOM	Forces Command
FOT&E	Follow-on Test and Evaluation
FSC2	Fire Support Command and Control
FY	Fiscal Year
FYDP	Five Year Defense Plan
GATM	Global Air Traffic Management
GDAMS	General Dynamics Amphibious Systems
GDLS	General Dynamics Land Systems
GE	General Electric
GPS	Global Positioning System
GR/CS	Guardrail/Common Sensor
HEMTT	Heavy Expanded Mobility Tactical Truck
HIMARS	High Mobility Artillery Rocket System
HMP	Helicopter Master Plan
HPOC	High Power Operational Capability
HPT	High Pressure Turbine
HUMS	Health Usage Monitoring System
ID/IQ	Indefinite Delivery/Indefinite Quantity
IETM	Interactive Electronic Technical Manual
IMC	Integrated Maintenance Concept

INSCOM	Intelligence and Security Command
IOC	Initial Operating Capability
IPDE	Integrated Product Data Environment
IPT	Integrated Product Team
IPV	Industrial Prime Vendor
ITAS	Improved Target Acquisition System
J-CAPS	JSTARS Cost and Performance System
JSECST	Joint Service Electronic Countermeasures System Tester
JSTARS	Joint Surveillance Target Attack Radar System
KC	Tanker Aircraft
KPP	Key Performance Parameters
LAN	Local Area Network
LCC	Life Cycle Costs
LDHD	Low Density High Demand
LFED	Lightweight Forward Entry Device
LIA	Logistics Information Agency (now Logistics Transformation Agency)
LM-Aero	Lockheed Martin Aeronautics
LMIS	Lockheed Martin Information Systems
LMLS	Lockheed Martin Logistics Services
L&MR	Logistics and Materiel Readiness
LORA	Level of Repair Analysis
LPD	Amphibious Transport Dock
LRU	Line Replaceable Unit
LSAR	Logistics Support Analysis Report
MACS-D	Multi-platform Common Source Database
MC	Mission Capable
MEMS	Micro- Electro-mechanical Devices
MHC	Minehunter, Coastal
MHSCo	Maritime Helicopter Support Company
MLRS	Multiple Launch Rocket System
MOA	Memorandum of Agreement
MTBF	Mean Time Between Failure
MTBUR	Mean Time Between Unscheduled Removal

MTVR	Medium Tactical Vehicle Replacement
MWO	Maintenance Work Order
NADEP	Naval Aviation Depot
NAVAIR	Naval Air Systems Command
NAVICP	Naval Inventory Control Point
NCCA	Naval Center for Cost Analysis
NDI	Non-Developmental Items
NEOF	No Evidence of Failure
NGC	Northrop Grumman Corporation
NIIN	National Item Identification Number
NMC	Non-Mission Capable
NSN	National Stock Number
OC-ALC	Oklahoma City Air Logistics Center
ODUSD	Office of the Deputy Under Secretary of Defense
OEM	Original Equipment Manufacturer
O&M	Operation and Maintenance
OO-ALC	Ogden Air Logistics Center
OPNAV	Chief of Naval Operations
OR	Operational Readiness
ORD	Operational Requirements Document
O&S	Operations and Support
OSCAM	O&S Cost Analysis Model
OSCR	Operations and Support Cost Reduction
OSD	Office of the Secretary of Defense
OSMIS	Operations and Support Management Information System
OT	Operational Testing
OTC	Oshkosh Truck Corp.
P2P	Point to Point
PBD	Program Budget Decision
PBL	Performance Based Logistics
PDF	Portable Document Format
PDM	Programmed Depot Maintenance
PDSS	Post-deployment Software Support

PEO	Program Executive Officer
PFRMS	Precision Fires Rocket and Missile Systems
PLS	Palletized Load System
PM	Program Manager
PMA	Planned Maintenance Availability
PMO	Program Management Office
PMOLCS	Program Manager Oversight of Life Cycle Costs
PMR	Provisioning Master Record
PMS	Program Management School
POC	Power Operational Capability
PPBS	Planning, Programming, and Budgeting System
PROSE	Partnership for Reduced O&S Costs, Engine
PSDSS	Product Support Decision Support System
PSP	Programmable Single Processor
PVS	Prime Vendor Support
RCM	Reliability Centered Maintenance
RECAP	Recapitalization
RERP	Reliability Enhancements and Re-engining Program
RF	Radio Frequency
RFID	Radio Frequency Identification
R&D	Research and Development
R&M	Reliability and Maintainability
RM&S	Reliability, Maintainability, and Supportability
ROI	Return on Investment
RPSTL	Repair Parts and Special Tools List
R-TOC	Reduction of Total Ownership Costs
RVSM	Reduced Vertical Separation Minimum
SBIR	Small Business Innovative Research
SBIRS	Space Based Infrared System
SCM	Supply Chain Manager
SDD	Systems Development and Demonstration
SE	Support Equipment
SEP	System Enhancement Program

SFL	Soldier Focused Logistics
SLAM-ER	Standoff Land Attack Missile, Expanded Response
SMA	Supply Management, Army
SMA	Supply Material Availability
SME	Subject Matter Expert
SPO	Systems Program Office
SRU	Subsystem Repairable Unit
SYSCOM	Systems Command
TACOM	Tank and Automotive Command
TAP	Team Armor Partnership
TLCSM	Total Life Cycle Systems Management
TM	Technical Manuals
TOA	Total Obligation Authority
TOC	Total Ownership Costs
TSC	Theater Surface Combatants
TSPR	Total Systems Performance Responsibility
TSSP	Total Systems Sustainment Program
TSSR	Total Systems Support Responsibility
TV	Television
USAF	U.S. Air Force
USAREUR	U.S. Army, Europe
USD (AT&L)	Under Secretary of Defense (Acquisition, Technology and Logistics)
USN	U.S. Navy
VE	Value Engineering
VECP	Value Engineering Change Proposal
VPV	Virtual Prime Vendor
WR-ALC	Warner-Robins Air Logistics Center
XML	Extensible Markup Language

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14. ABSTRACT The purpose of the Reduction of Total Ownership Costs (R-TOC) program is to achieve readiness improvements in weapon systems by improving the reliability of the systems or the efficiency of the processes used to support them. New technologies and management practices may provide significant opportunities to improve readiness and reduce ownership costs. Some DoD programs have achieved similar successes in adopting private sector improvements in logistics and supply chain management. The purpose of R-TOC is to maintain or improve current readiness while reducing operations and support (O&S) costs. The Services were instructed to focus on: (1) Reliability and maintainability (R&M) improvements, (2) Reduction of supply chain response time and reduction of logistics footprint, and (3) Competitive Product Support. Each Service began 10 Pilot Programs to test R-TOC approaches and report on their experiences. The documentation and dissemination of Best Practices is one of the central purposes of the R-TOC program. The experience of the Pilot Programs has shown that R-TOC works. Sharing these experiences with other programs can help with the more widespread implementation of R-TOC.					
15. SUBJECT TERMS Best Practices, Efficiency, Improvements, Logistics Footprint, Maintainability, Management, Ownership Costs, Operations, Pilot Programs, Processes, Readiness, Reduction, Reliability, R-TOC, Supply Chain, Support, and Technologies.					
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